BPNF 80

USER MANUAL

Reference of the document: **MU-BPNF80-1.3-EN**

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FOREWORD

Aim of this manual

This manual shows how to install and use a BPNF80.
An initial introduction describes BPNF80 in general followed by a presentation of the BPNF80 2, BPNF80 2D and BPNF80 4D products.

Document reference encoding

The reference coding structure for a manual is:

MU-<product name>-V.E-L

where:

MU = User Manual
V = version
E = evolution (minor modification)
L = language used for the manual

Updates

1.0 : creation
1.1 : **Id** led modification
1.2 : add annexes 3 and 4
1.3 : add acyclic modules, diagnostic description and optional functions

Glossary

RFID : Radio-frequency Identification
CRC : Cyclical Redundancy Check
UID : Unique Identifier
TAG : object accessed using RFID
RTC : Real Time Cyclic

Important Note

Information in this document is not binding.
BALOGH Company reserves the right to modify our product in line with our policy of continuous product development.
BALOGH Company will not be responsible of possible consequences or errors due to worst use of the product. The use of this device must ensure that all the necessary steps have been taken to verify that the application meets all performance and safety requirements.

Profinet is managed by Profibus and Profinet International (PI).

1. INTRODUCTION TO BPNF80

1.1 GENERAL INFORMATION

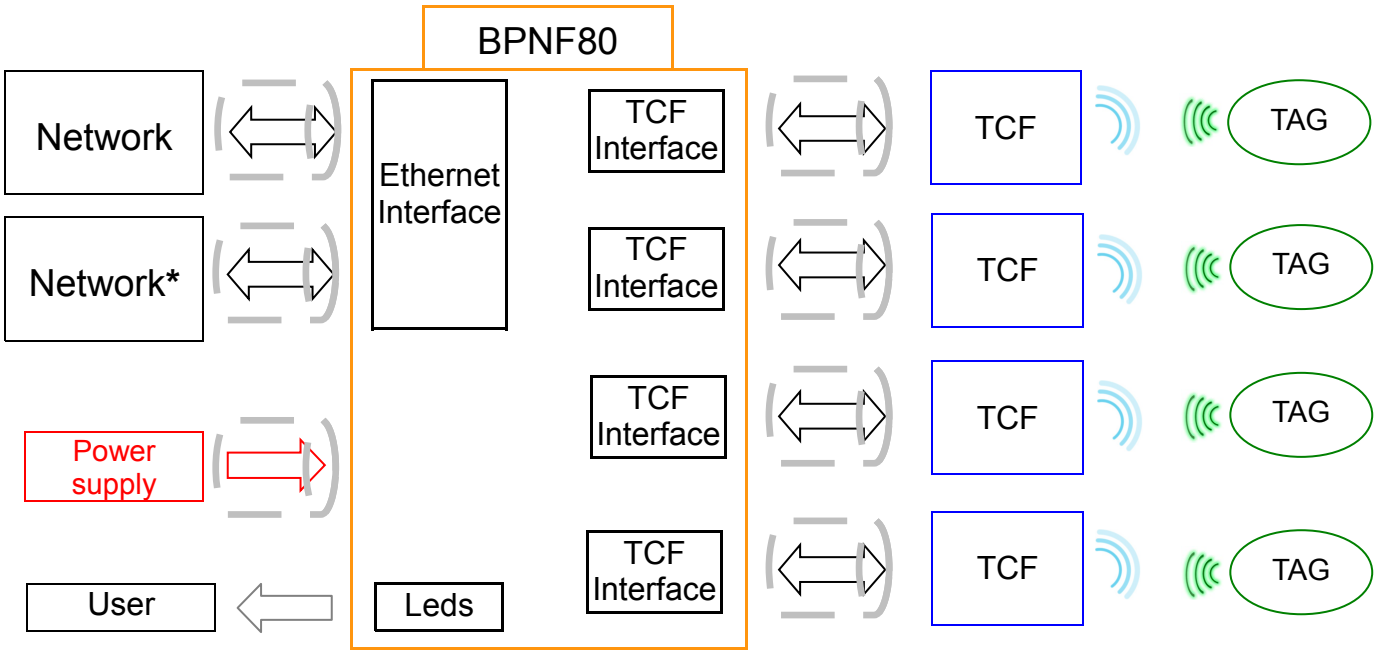
The BPNF80 module is a single board Ethernet solution for Automatic Identification. The BPNF80 module integrates BALOGH'S Passive Radio Frequency Identification Technology and the Ethernet architecture into one field mountable enclosure.
The BPNF80 module is designed to manage two or four BALOGH Transceiver channels (TCF) and allows the user to pass Tag data across an Ethernet network with a simple set of instructions :

- Tag identification
- read data
- write data
- read/write data

It communicates using Profinet protocol.

Configuration and maintenance services are realised with a internal Web server.

The figure below illustrates the basic properties of the BPNF80 (the 4 channels one):



Network: the supervisor network that sends commands and receives responses from the BPNF80
Network*: extended Ethernet network to chain others Ethernet equipements
Power supply : interface that provides power
User: user that observes status Leds behavior
TCF: Balogh transceiver used to radio-frequency communication
TAG: object accessed using radio-frequency communication

1.2 PRODUCT REFERENCES

The 3 product models of BPNF80 are detailed below:

---------- **BPNF80 2** ----------

- 1 power supply interface
- 1 Ethernet interface
- 2 transceivers interfaces
- 5 leds

---------- **BPNF80 2D** ----------

- 1 power supply interface
- 2 Ethernet interfaces
- 2 transceivers interfaces
- 6 leds

---------- **BPNF80 4D** (full version) ----------

- 1 power supply interface
- 2 Ethernet interfaces
- 4 transceivers interfaces
- 12 leds
- Opto-isolated product

1.3 PRODUCT SUMMARY

Hardware characteristics

Model	Ethernet ports number	RFID channel number	Led number	Opto-isolated
BPNF80 2	1	2	5	No
BPNF80 2D	2	2	6	No
BPNF80 4D	2	4	12	Yes

Software characteristics

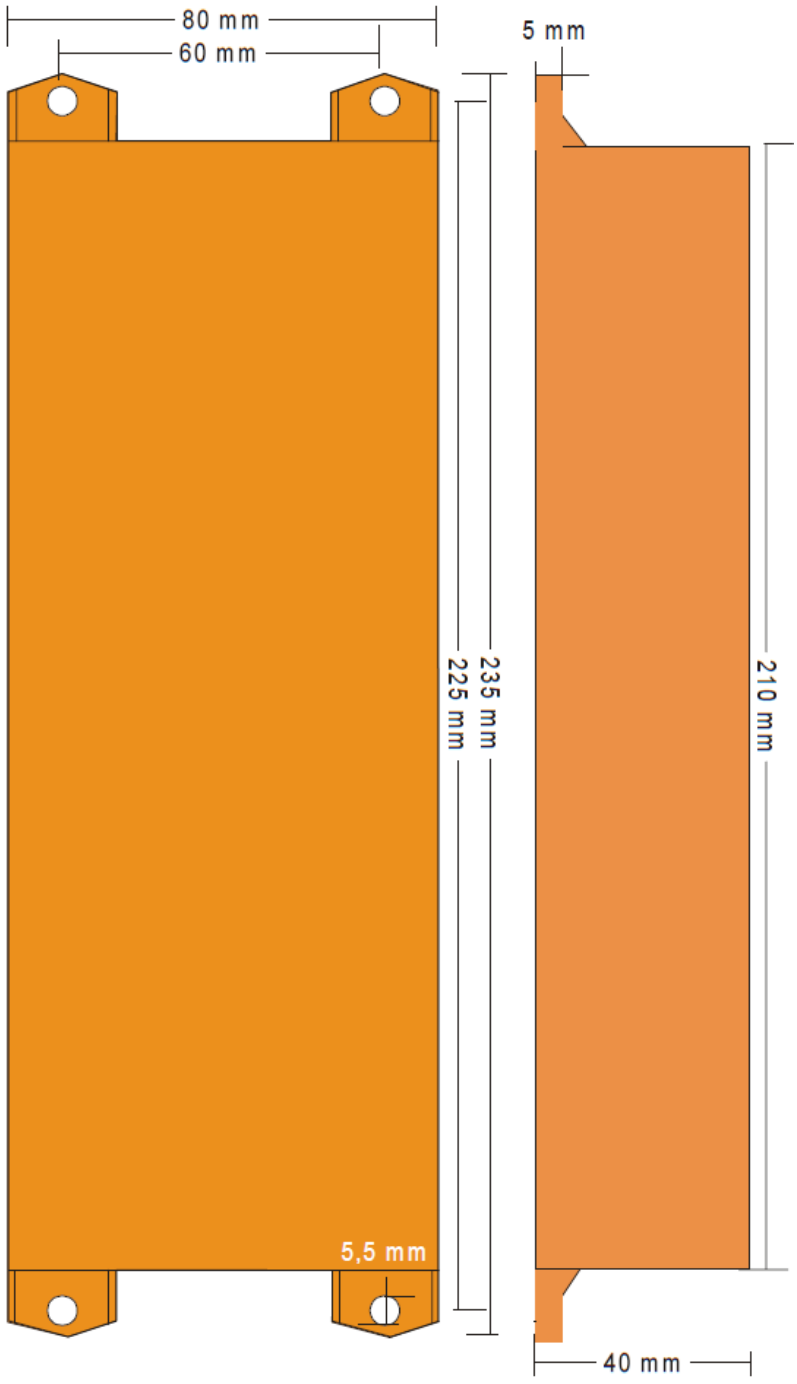
Profinet modules	Max data Length (in bytes)	Module ID	Information
Cyclic UID	8 (UID)	0x0001	One module used to retreive UID tag
Cyclic data read	8 16 32 64 128 256 512	0x0101 0x0102 0x0104 0x0108 0x0110 0x0120 0x0140	7 modules used to read data into a tag
Cyclic data write	8 16 32 64 128 256 512	0x0201 0x0202 0x0204 0x0208 0x0210 0x0220 0x0240	7 modules used to write data into a tag
Cyclic data generic	8 16 32 64 128 256 512	0x0301 0x0302 0x0304 0x0308 0x0310 0x0320 0x0340	7 modules used to: - retreive UID - read tag data - write tag data - fill tag
Acyclic patial	64 K (64 pages of 1 K)	0x1000	One module to read, write, fill data into a tag. Command bytes are sent **cyclically** and data **acyclically**.
Acyclic full	64 K (64 pages of 1 K)	0x2000	One module to read, write, fill data into a tag. Command and data bytes are sent **acyclically**.

2 INSTALLATION

2.1 MOUNTING

A BPNF80 must be mounted using four 5 mm diameter screws (length under head ≥ 10 mm).

House sizes are:

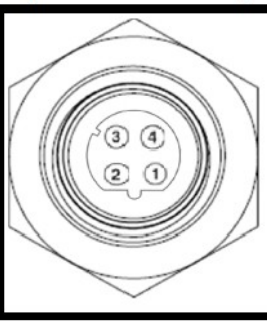


2.2 CONNECTION

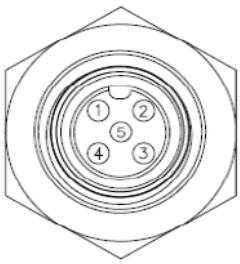
2.2.1 BPNF80 2

Connectors are based on M12 standard:

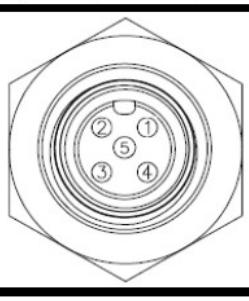
Pin	**ETHERNET** (M12 4 pins female D coded)
1	Tx+
2	Rx+
3	Tx-
4	Rx-



Pin	**CHANNEL** (M12 5 pins female)
1	24V (OUT)
2	S
3	E
4	0 V
5	NC

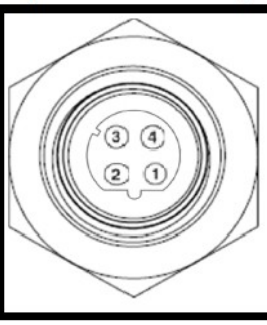


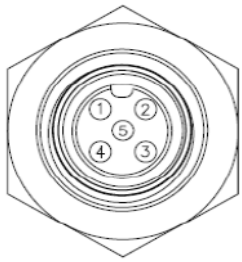
Pin	**POWER 24VDC** (M12 5 pins male)
1	24V (IN)
2,3	NC
4	0 V
5	NC

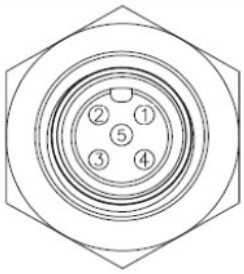


2.2.2 BPNF80 2D

Connectors are based on M12 standard:

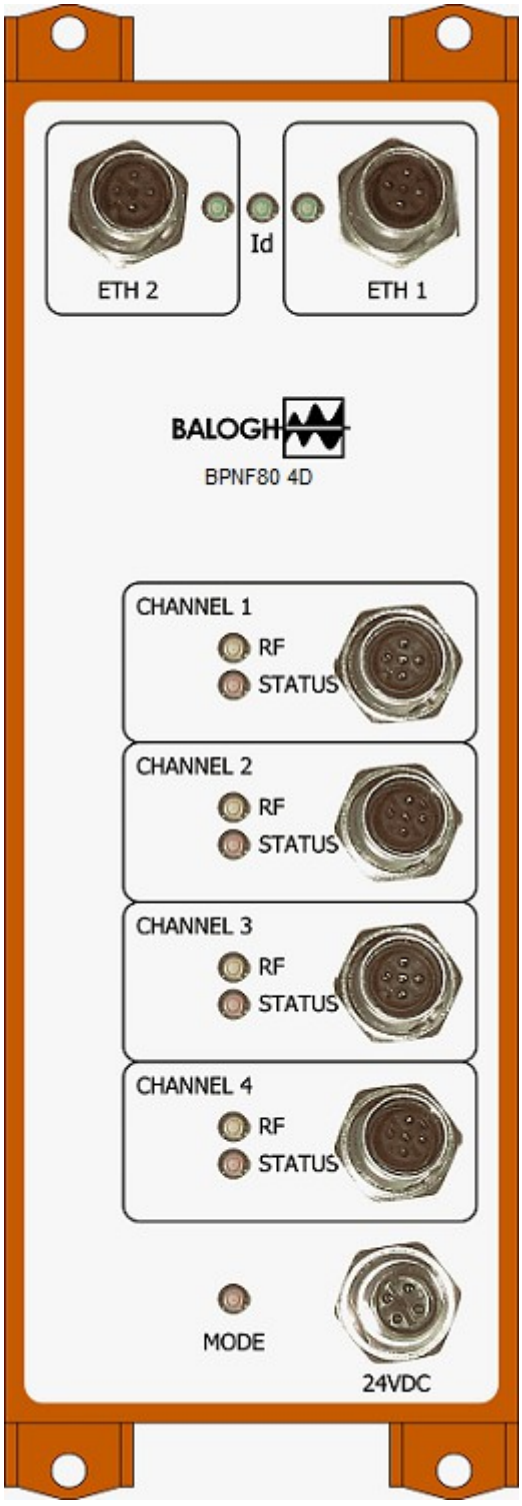
Pin	**ETHERNET** (M12 4 pins female D coded)	
1	Tx+	
2	Rx+	
3	Tx-	
4	Rx-	

Pin	**CHANNEL** (M12 5 pins female)	
1	24V (OUT)	
2	S	
3	E	
4	0 V	
5	NC	

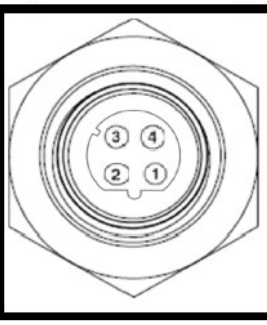
Pin	**POWER 24VDC** (M12 5 pins male)	
1	24V (IN)	
2,3	NC	
4	0 V	
5	NC	

2.2.3 BPNF80 4D

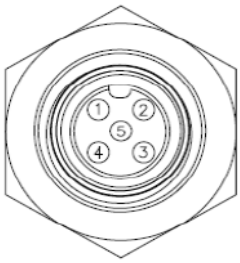
Connectors are based on M12 standard:



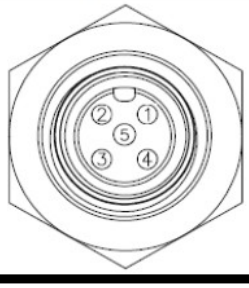
Pin	**ETHERNET** (M12 4 pins female D coded)
1	Tx+
2	Rx+
3	Tx-
4	Rx-



Pin	**CHANNEL** (M12 5 pins female)
1	24V (OUT)
2	S
3	E
4	0 V
5	NC



Pin	**POWER 24VDC** (M12 5 pins male)
1	24V (IN)
2,3	NC
4	0 V
5	NC



2.3 INTERFACE DESCRIPTION

2.3.1 POWER SUPPLY (**24VDC**)

This interface uses a M12 5 pins male connector to power the BPNF80.

It is required to use a regulated 24 VDC power supply, applying +24VDC on pin 1 and 0 VDC on pin 4.

The maximum power consumption may vary with number of transceiver connected. The others pins (2, 3, 5) must be not connected.

The next table presents the typical and maximum current consumption for each of the BPNF80 products and does not take into account the transceivers (TCF) consumption.

To know TCF consumption, please see specific TCF specification sheet.

Consumption (mA) Product	Typical (out of TCF)	Maximal (out of TCF)
BPNF80 2	125	150
BPNF80 2D	132	150
BPNF80 4D	170	185

To calculate the maximal power consumption of an architecture, see the annex 2 where an exemple is given for a BPNF80 2D.

2.3.2 NETWORK INTERFACE (**ETH 1** / **ETH 2**)

Ethernet uses a M12 4 pins D coded female connector to be interface with the supervisor. A standard 10/100 Mbps link can be used.

The 2 connectors named 'ETH 1' and 'ETH 2' are managed identically by the BPNF80 (*Importante note*: “ **BPNF80 2** ” product has only one Ethernet connection).
So, supervisor or Ethernet network extention could be plugged with no difference in the one or the second Ethernet connector.

Product network configuration (described in chapter 4) is done with Web server pages reached from the network interface.
BPNF80 IP address can also be modified with a specific application named '**Balogh Ethernet Config**'. This tool is responsible for finding products even if IP parameters are not on the same network or are unknown.
This application is described in the chapter 4.

The Ethernet industrial protocol is **Profinet** (described in chapter 5).

2.3.3 TCF INTERFACE (**CHANNEL X**)

TCF (Balogh transceivers) are connected via M12 5 pins female connectors.
This interface provide power and communication to TCF.

BPNF80 products provide 2 or 4 TCF interfaces in function of their models:
- 2 channels: **BPNF80 2D** and **BPNF80 2**,
- 4 channels: **BPNF80 4D**.

Use a shielded cable to connect TCF with BPNF80.

2.3.4 LEDS

Led Number changes in function of product models. The table below describes led operating:

BETF80		Led	State	Meaning
4D	2	Mode	Green and red	Init 1 : bootloader starting
			Orange flashing	Init 2 : system initialisation
			Fast green flashing	Init 3 : Services launching
			Slow green flashing	Init 4 : Ethernet stack initialisation
			Green	Normal operation
			Green and red flashing	Normal operation but last radio contract error
	or	Ethernet	Off	No connection
			Green	Connected
			Green flashing	Connected and activity
	2D	ID	Off	Ethernet protocol not initialised
			Green flashing	Ethernet protocol started : waiting for connection
			Green	At least one client connected
		RF	Orange flashing	Error, no TCF connected to the channel
			Low orange	TCF ok, no Tag
			High orange	TCF ok, Tag presence
		Status	Green	Executing a command on the TCF channel
			Red	Error during last command execution on the TCF channel

3 COMMUNICATION

3.1 ADDRESSES

3.1.1 MAC ADDRESS

Each BPNF80 has a predefined address, named MAC address (Media Access Control), unique, composed of 6 bytes in this format :

- high bytes : 3 bytes that give compagny identifiant, for Balogh is 0050C2h,
- low bytes : 3 bytes that give product family. For BPNF80, this 3 bytes are written on the housing side:

10	8x	xx

For BPNF80 products with 2 Ethernet interfaces (**BPNF80 2D** and **BPNF80 4D**), each of the Ethernet port also has a unique MAC address. ETH1 and ETH2 MAC address numbers are:

- ETH1 MAC address = (the Product MAC address) **+ 1**

- ETH2 MAC address = (the Product MAC address) **+ 2**

Example: a BPNF80 2D with the MAC address 0x0050C2108FA6, its ETH1 port has the MAC address 0x0050C2108FA7 and the ETH2 port 0x0050C2108FA8.

3.1.2 IP ADDRESS

Each BPNF80 has the default IP address : 0.0.0.0. as required by Profinet specifications.
In use, this address is set by Profinet supervisor but It can be set by user (static IP) or forced by a DHCP server (see chapter 4 to configure the BPNF80).

3.2 PROTOCOL

The BPNF80 is a Profinet IO device compliant with 2.3 Profinet IO specification version.
All BPNF80 Profinet explanations are given in chapter 5.

3.3 OTHERS SERVICES

3.3.1 FIRMWARE UPDATE (MAINTENANCE)

It is possible to update BPNF80 firmware using the Web server. The procedure is given into the chapter 7.

3.3.2 SUPERVISION, CONFIGURATION AND DIAGNOSTIC

HTTP protocol can be used to (for example):

- detect TAG on each TCF channel,
- show BPNF80 configuration and see current parameters,
- modify IP address via a html page,
- display diagnotics counters.

To establish a HTTP session, user must have a web browser on the used station and connect it to the BPNF80 IP address.

3.4 INITIALISATION

At power on, the BPNF80 initialisation is done and the leds gives the information below:
1- MODE led lights in green (Bootloader)
2- MODE led lights in red (Bootloader)
3- MODE led flashing fastly in orange (basic services launching)
4- MODE led flashing slowly in green (Ethernet stack initialisation)
5- MODE led in green (normal operation)

BPNF80 boot time is about 20 seconds (it does not depend on IP addressing mode).

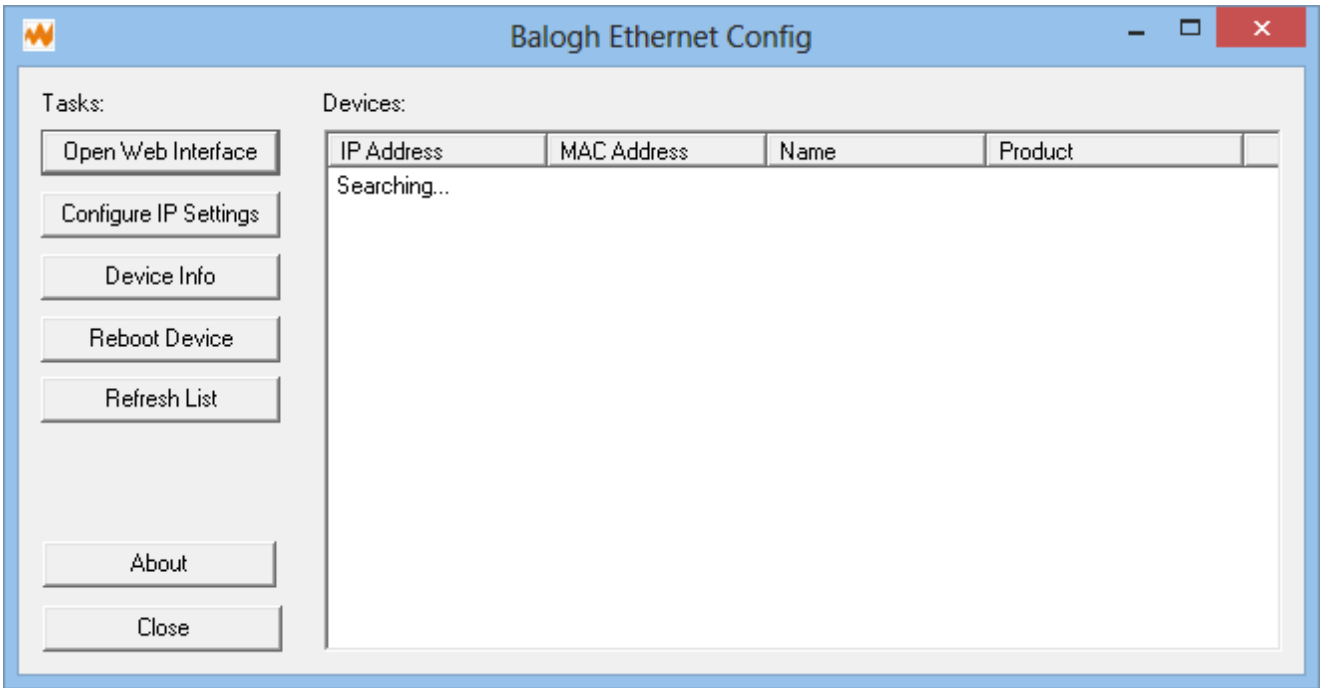
4 CONFIGURATION

4.1 IP PARAMETERS

4.1.1 USING « BALOGH ETHERNET CONFIG » APPLICATION

BPNF80 configuration can be done via Ethernet interface using '**Balogh Ethernet Config**' application or using a Web Browser.

« Balogh Ethernet Config » tool appears like this:



buttons have these functions:

Open Web Interface
Launch a web browser on the product web server home page.

Configure IP Settings
Easy to use interface to change IP parameters.

Device Info
Give general information like product name, firmware version, Network parameters …

Reboot Device
Force a software reboot of the product.

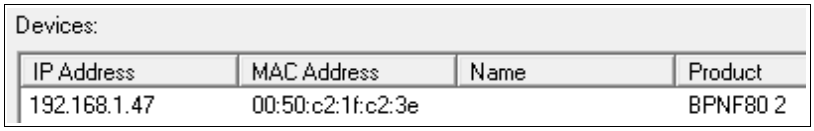
Refresh List
Start a product research into the network.

About
Relative information of **Balogh Ethernet Config** version.

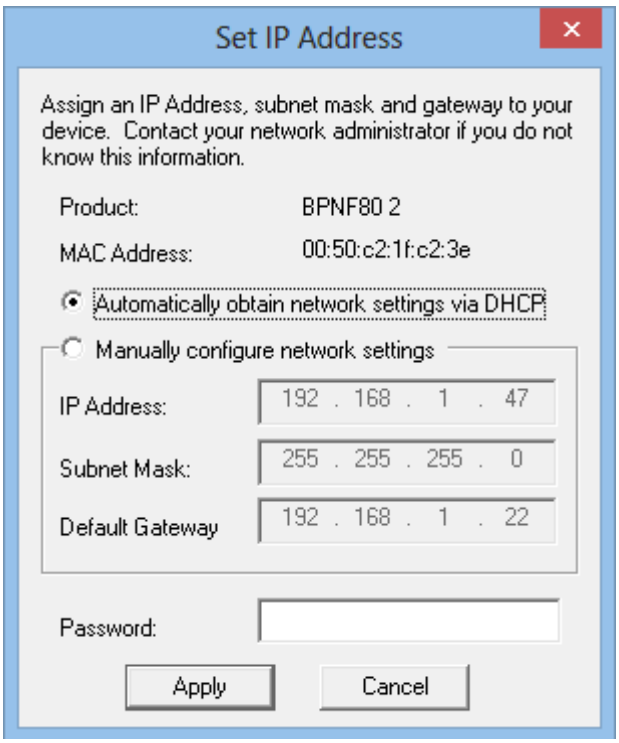
Close
Close application.

Example:

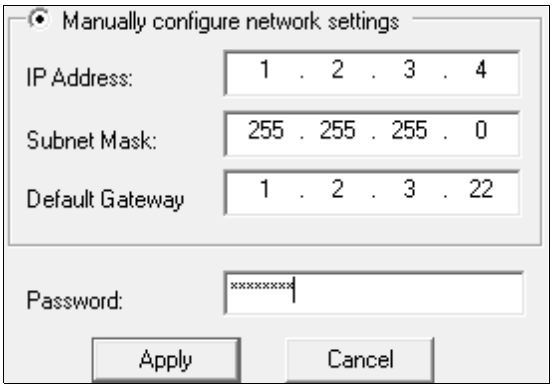
Suppose a BPNF80 2D connected to a *192.168.1* network address. When the application is launched, the product could be detected as:



Click on the '**Configure IP Settings**' button, the window below is displayed:


Set IP Address
Assign an IP Address, subnet mask and gateway to your device. Contact your network administrator if you do not know this information.
Product:
BPNF80 2
MAC Address:
00:50:c2:1f:c2:3e
Automatically obtain network settings via DHCP
Manually configure network settings
IP Address:
192 . 168 . 1 . 47
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway
192 . 168 . 1 . 22
Password:
Apply
Cancel

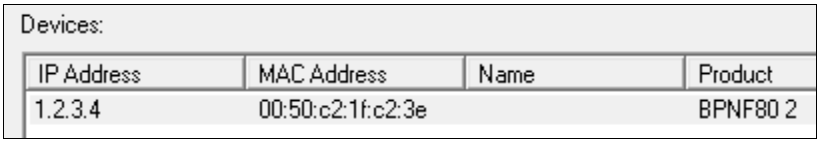
In this example the BPNF80 are configured using a DHCP server. It is possible to modify these parameters so as to force the product to have other network adresse *1.2.3*:



Warning : Password is the one defined for the product. By default is **balogh** .

Click on the 'Apply' button that new parameters are set into the product. The product must be restarted for changes to take effect. Click on '**Reboot Device**' button.

After few seconds (product restart), the BPNF80 2D is detected, click on '**Refresh List**' button. Even if the product has a different network configured, it is well detected by the application:

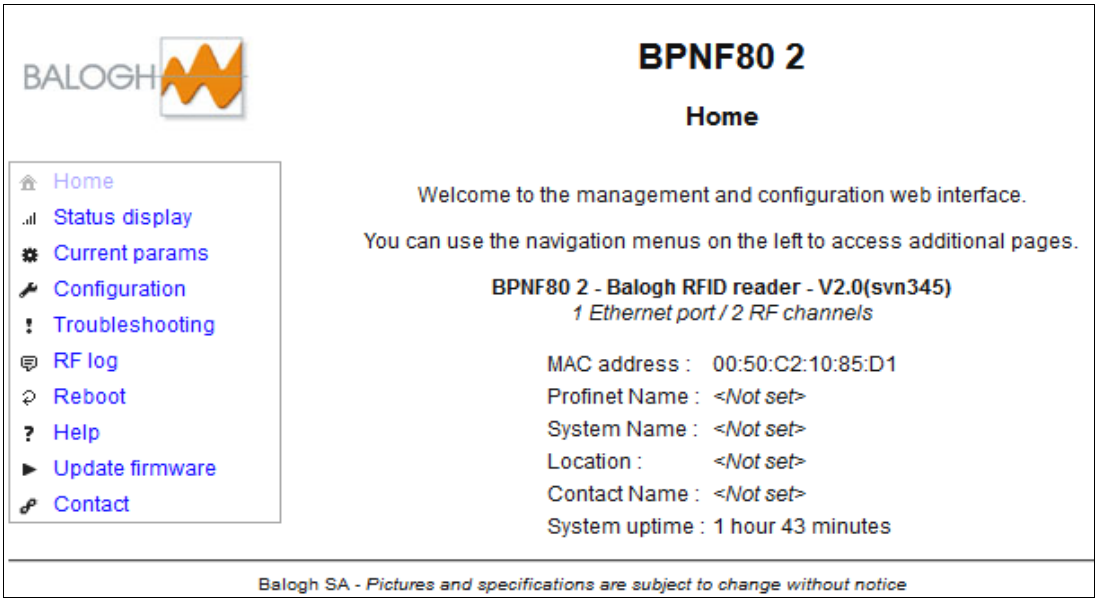


4.1.2 USING WEB SERVER

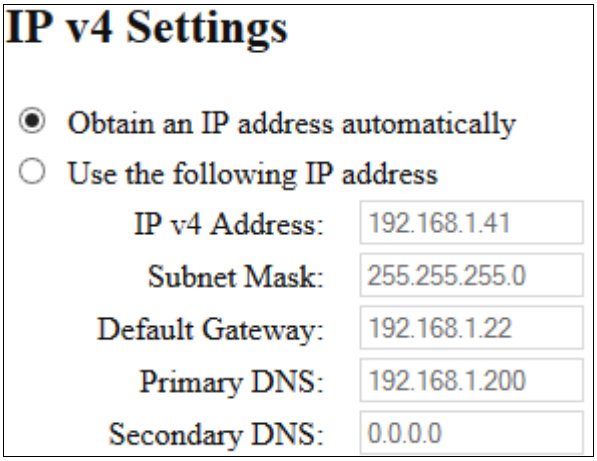
Web browser can be used even if the product has the same network parameters than the station of configuration (PC).

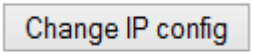
To connect to BPNF80 web server, enter the IP address of the product in the address bar. Set or retrieve IP address using '**Balogh Ethernet Config**' if necessary.
The product is protected by a user account, please give Account name and password (by default it is 'root' and 'balogh').

The BPNF80 home page is:



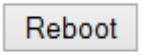
Click on the BPNF80 'Configuration' link to go to the configuration page. « Ipv4 Settings » field is used to change IP settings:



Once configuration is chosen (DHCP ou user static address), click on  button.
This message must be displayed:

Settings have been saved. You must reboot for changes to take effect.

It indicates that the BPNF80 must be reboot for new parameters are set.
For this, just need to click on the 'Reboot' link.

On the reboot page click on  bouton.

The product is restarting with the new parameters. To test that the new IP was changed on the device, re-enter the new address in the brower.

4.1.3 USING DCP PROTOCOL

The **D**iscovery and basic **C**onfiguration **P**rotocol (**DCP**) is used by the Profinet IO-Controller during connection to assign the IP address of the BPNF80.

4.2 RADIO-FREQUENCY PARAMETERS

the RF parameters are always written during the communication establishment phase (in Profinet Protocol) beetween the IO-Controller and the IO-Device (BPNF80). This is the only way to configure these parameters.

It is possible to choose between 3 radio frequency modes used to configure the communication between the TCF and the TAG.

These 3 modes are selected per channel, they are:

- ***ISO & extended ISO*** (index 0): the default mode complying with the ISO15693 and 18000-3 standards. The used rate si 26Kbits/s. Data exchanges are done in bloc number and a bloc size can be 4 or 8 bytes length (depend of TAG used).

- ***Balogh 52K*** (index 1): Balogh radiofrequency protocol used with Balogh TAG (named TAM). This mode has 2 benefits, its rate is double at 52Kbits/s (allowing shorter dialogue times) and data can be exchanged in byte.

- ***ISO 15693 26/52Kbps*** (index 2): a specific mode used by TAG with Fujitsu microchip inside. In this mode the transceiver transmission uses a 26Kbits/s rate and the reception uses a 52Kbits/s rate. Data exchanges are done in bloc number of 8 bytes length.

The index number is the number transmitted during Profinet device configuration to choose the RF mode.

5 PROFINET PROTOCOL

5.1 GENERAL INFORMATION

PROFINET is the open industrial Ethernet standard of PROFIBUS & PROFINET International (PI) for automation. PROFINET uses TCP/IP and IT standards, and is in effect, real-time Ethernet. The PROFINET concept features a modular structure so that users can select the cascading functions themselves. They differ essentially because of the type of data exchange to fulfill the partly very high requirements of speed.
In conjunction with PROFINET, the two perspectives PROFINET CBA and PROFINET IO exist. PROFINET CBA is suitable for the component-based communication via TCP/IP and the real-time communication for real-time requirements in modular systems engineering. Both communication options can be used in parallel.

PROFINET IO was developed for real time (RT) and isochronous real time (IRT) communication with the de-centralized periphery. The designations RT and IRT merely describe the real-time properties for the communication within PROFINET IO.
To achieve these functions, three different protocol levels are defined:

- TCP/IP for PROFINET CBA and the commissioning of a plant with reaction times in the range of 100ms
- RT (Real-Time) protocol for PROFINET CBA and PROFINET IO applications up to 1 ms cycle times
- IRT (Isochronous Real-Time) for PROFINET IO applications in drive systems with cycles times of less than 1ms

Interfacing the peripherals devices such as BPNF80 is implemented by PROFINET IO. Its basis is a cascading real-time concept. PROFINET IO defines the entire data exchange between controllers (devices with "master functionality") and the devices (devices with "slave functionality"), as well as parameter setting and diagnosis.

PROFINET IO is designed for the fast data exchange between Ethernet-based field devices and follows the provider-consumer model. The configuration of an IO-System has been kept nearly identical to the "look and feel" of PROFIBUS.

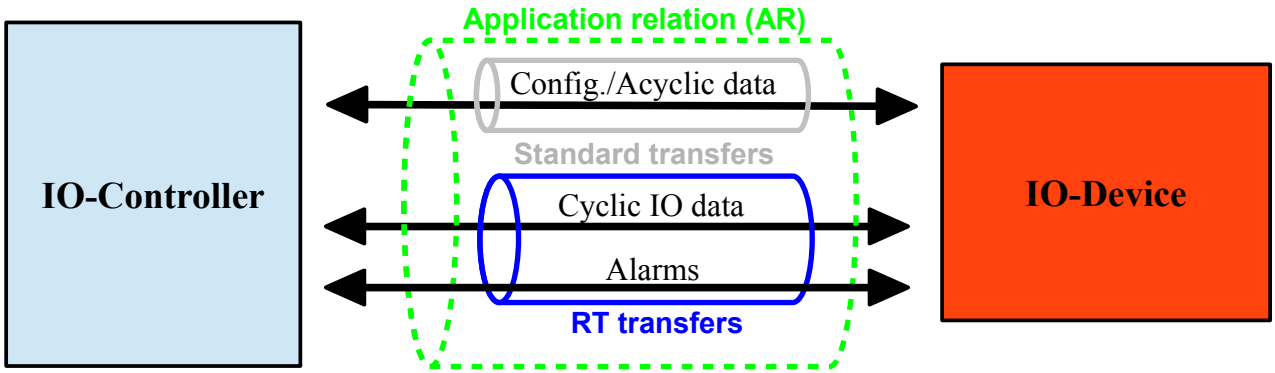
A PROFINET IO-system consists of the following devices:

- The IO-Controller, which controls the automation task.
- The IO-Device, which is a field device such as an encoder, monitored and controlled by an IO-Controller.
- The IO-Supervisor is software typicall y based on a PC for setting parameters and diagnosing individual IO-Devices.

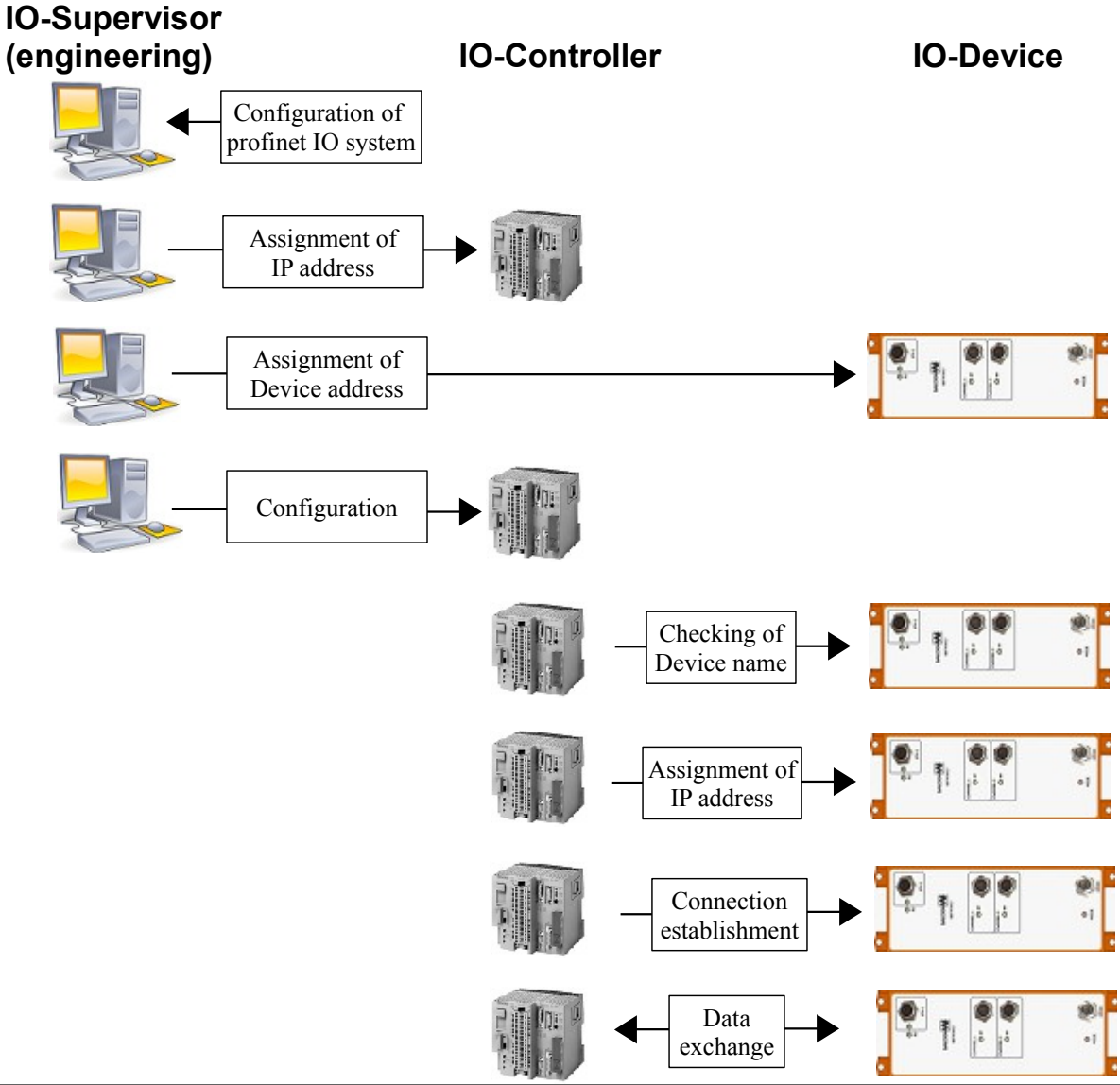
An application relation (AR) is established between an IO-Controller and an IO-Device. These ARs are used to define communication relations (CR) with different characteristics for the transfer of parameters, cyclic exchange of data and handling of alarms.

The characteristics of an IO-Device are described by the device manufacturer in a General Station Description (GSD) file. The language used for this purpose is the GSDML (GSD Markup Language) - an XML based language. The GSD file provides the supervision software with a basis for planning the configuration of a PROFINET IO system.

Within PROFINET IO, process data and alarms are always transmitted in real time (RT). Real time in PROFINET is based on the definition of IEEE and IEC, which allow for only a limited time for execution of real-time services within a bus cycle. The RT communication represents the basis for the data exchange for PROFINET IO and real-time data are always treated with a higher priority than TCP (UDP)/IP data.



These scheme give the steps from configuration up to system startup:



5.2 FUNCTIONALITIES

5.2.1 CLASS OF CONFORMANCE

BPNF80 IO-Device is in accordance with ***Conformance Class B*** and theirs functionalities supported are:

- Profinet IO with Real-time communication
- Cyclic input and output
- Acyclic parameter data (Read / Write record)
- Device diagnostics (alarms)
- Identification & Maintenance I&M0 (HW/FW)
- Topology information (LLDP)
- Port-related network statuses (PDEV)
- Network diagnostic via IP (SNMP)

BPNF80 IO-Device supports others functionalities that are not **Class B** standard but **optional**:

- Extended device identification (location designation, installation date ...) I&M 1-4
- Automatic addressing after device replacement
- MRP (Media Redundancy Protocol) only for product with 2 Ethernet ports (with 'D' letter in commercial references)

5.2.2 REAL-TIME (RT) CYCLE TIME

BPNF80 can be used for process real-time IO-data transfer with a cycle time of up to **8 ms**.

It is important **to set the RT cycle time Interval for an update time suitable for the application**.
The update time chosen determines how often the IO-Controller will receive Input Image updates from the BPNF80.
A very long RT cycle time will result in events taking place at the BPNF80 module that may never seen by the IO-Controller.

5.3 BPNF80 DEVICE IDENTIFICATION

5.3.1 PRODUCT IDENTIFICATION

All Profinet equipment must have unique identification information when using severals ways of communication (DCP, SNMP, LLDP, Profinet acyclic, in GSD). The table below presents the list of needed information:

Specific BPNF identification	
Vendor name	“BALOGH”
Vendor identifier	0x295
Device identifier	0x1000
Product main family	“Ident System”
Vendor product family	“Balogh RFID product”

5.3.2 DEVICE ACCESS POINT (DAP)

This table presents the DAP for each product reference:

Product refrence	DAP ModuleIdentNumber	Order Number / Order ID	PhysicalSlots	Number of PortSubmodule
BPNF80 2	0x1200	BPNF80 2	0..2	1
BPNF80 2D	0x2200	BPNF80 2D	0..2	2
BPNF80 4D	0x2400	BPNF80 4D	0..4	2

Each DAP has a startup parameter by radiofrequency channel. This parameter is the **RF mode** defined in chapter 4.2.

So as to configure the slot (RF channel) during initialisation, the parameter for each slot must be:

value	RF mode
0	ISO & extended ISO
1	Balogh 52K
2	ISO 15693 26/52Kbps

BPNF80 2 DAP

Module 0: Device Access Point	
Information	Value
Module ID	0x1200
Information	“Profinet interface for 2 TCF transceivers (1 Ethernet port)”
Vendor Name	“BALOGH”
Order Number	“BPNF80 2”
Hardware release	“B”
Software release	“V.1.0.0.0”
Category	“Ident Systems”
Startup parameters	Value range
RF mode channel 1	0x0 to 0xF*
RF mode channel 2	0x0 to 0xF*

*used values: 0 to 2

BPNF80 2D DAP

Module 0: Device Access Point	
Information	Value
Module ID	0x2200
Information	“Profinet interface for 2 TCF transceivers (2 Ethernet ports)”
Vendor Name	“BALOGH”
Order Number	“BPNF80 2D”
Hardware release	“B”
Software release	“V.1.0.0.0”
Category	“Ident Systems”
Startup parameters	Value range
RF mode channel 1	0x0 to 0xF*
RF mode channel 2	0x0 to 0xF*

*used values: 0 to 2

BPNF80 4D DAP

Module 0: Device Access Point	
Information	Value
Module ID	0x2400
Information	“Profinet interface for 2 TCF transceivers (4 Ethernet ports)”
Vendor Name	“BALOGH”
Order Number	“BPNF80 4D”
Hardware release	“B”
Software release	“V.1.0.0.0”
Category	“Ident Systems”
Startup parameters	Value range
RF mode channel 1	0x0 to 0xF*
RF mode channel 2	0x0 to 0xF*
RF mode channel 3	0x0 to 0xF*
RF mode channel 4	0x0 to 0xF*

*used values: 0 to 2

The next chapter presents the cyclic and acyclic modules with respectively function to:

- cyclic module to Read UID TAG
- cyclic modules to Read data into a TAG
- cyclic modules to Write data into a TAG
- cyclic and acyclic modules that realise many commands into a TAG (read, write, write/read, fill, detect UID ….)

5.4 BPNF80 MODULES PRESENTATION

The documentation named **“Profinet Balogh Module Exemples”** present in details the S7 LAD samples of read and write command executions. You can find it into the Balogh Technical center : www.*technical.balogh-rfid.com/fr* .

5.4.1 CYCLIC UID READ MODULE

A single module so as to continuously read the UID TAG on a channel. Used with RF status byte or Status word, the UID TAG can be:

- if **Target Present** bit = 0 (*Status word*) or **TAG Presence** bit = 0 (*RF status byte*)
  => The UID data is the last UID TAG pesented in front of the transceiver
- if **Target Present** bit = 1 (*Status word*) or **TAG Presence** bit = 1 (*RF status byte*)
  => The UID data is the one of the TAG currently in front of the transceiver

Module 0x0001: Read UID		
Information	Value	
Module ID	0x0001	
Module name	“Read UID”	
Information	“Read continously the UID tag”	
Input data	Offset in the module	Length in bytes
Control word	0	2
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1
UID value	3	8
Acyclic parameter	Default value	Value range
None	None	None

5.4.2 CYCLIC DATA READ MODULES

Different modules could be used to read data into a TAG on a channel. These read only modules present parameters to control the read command:

- Address : address word where the read starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Size : size word is the read data length given in a granularity of byte.
- Timeout : the wait time before terminating the attempt to execute the command and generating an error. Time interval is 10ms (1 = 10ms, 2 = 20ms …):
  - 0 value => the command is executing immediately
  - 0xFFFF value => the wait time is infinite (command will be executed only if a TAG is been presented in front of the transceiver).

7 read only modules are presented below, the differentiation is done with their size of read data.

Mapping of modules		
Input data	Offset in the module	Length in bytes
Control word	0	2
Address	2	2
Size	4	2
Timeout	6	2
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1
Data read	3	**

Module ID	Module Name	** Length in bytes (size of “Data read”)
0x0101	Read 8 bytes CYC	8
0x0102	Read 16 bytes CYC	16
0x0104	Read 32 bytes CYC	32
0x0108	Read 64 bytes CYC	64
0x0110	Read 128 bytes CYC	128
0x0120	Read 256 bytes CYC	256
0x0140	Read 512 bytes CYC	512

5.4.3 CYCLIC DATA WRITE MODULES

Different modules could be used to write data into a TAG on a channel. These write only modules present parameters to control the write command:

- Address : address word where the write starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Size : size word is the write data length given in a granularity of byte.
- Timeout : the wait time before terminating the attempt to execute the command and generating an error. Time interval is 10ms (1 = 10ms, 2 = 20ms …):
  - 0 value => the command is executing immediately
  - 0xFFFF => the wait time is infinite (command will be executed only if a TAG is been presented in front of the transceiver).
- Data to write : the values of the data bytes to write into the memory TAG

7 write only modules are presented below, the differenciation is done with their size of write data.

Mapping of modules		
Input data	Offset in the module	Length in bytes
Control word	0	2
Address	2	2
Size	4	2
Timeout	6	2
Data to write	8	**
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1

Module ID	Module Name	** Length in bytes (size of “Data to write”)
0x0201	Write 8 bytes CYC	8
0x0202	Write 16 bytes CYC	16
0x0204	Write 32 bytes CYC	32
0x0208	Write 64 bytes CYC	64
0x0210	Write 128 bytes CYC	128
0x0220	Write 256 bytes CYC	256
0x0240	Write 512 bytes CYC	512

5.4.4 CYCLIC DATA GENERIC MODULES

Generic modules could be used to realise many functions into a TAG on a channel. These functions are defined into a byte named **Command** that can has value and corresponding function defined in this table:

Command (the 3th byte into generic module)	
Value	**Description**
1	Read data
2	Write data
3	Write and read data
4	Fill data (with a byte value)
5	Get last UID

Write and read data command (0x3) is used to write data into a TAG and to read data from a TAG with the same request. Write request is realised first and the parameters are sent using **write address**, **size** and **data to write** elements into the module. After the write, the read request is done and parameters used are **read address** and **read size**. The result of the read command are placed into the **data read** element into the module.

Fill data command (0x4) is used to fill a TAG memory area with a specific pattern. This pattern is the first byte of the **Data to write** element in the module. The **address** and the **size** are the ones used for Write command.

Get last UID command (0x5) is used to retreive the last or current UID TAG as explained in the Read UID module (see chapter 5.4.1). The UID value is present into the first 8th bytes of the **Data read** element in the module.

All the paramters of the modules are:

- Command : byte command to set the request.
- Read address : address word where the read starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Read size : read size word is the asked read data length given in a granularity of byte.
- Write address : address word where the write starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Write Size : size word is the write data length given in a granularity of byte.

- Timeout : the wait time before terminating the attempt to execute the command and generating an error. Time interval is 10ms (1 = 10ms, 2 = 20ms …):
  - 0 value => the command is executing immediately
  - 0xFFFF => the wait time is infinite (command will be executed only if a TAG is been presented in front of the transceiver).
- Data to write : the values of the data bytes to write into the memory TAG. Also used to transmit the fill pattern byte.
- Data read : the result of the data read from the TAG memory. Also used to retreive Last UID TAG if Get last UID command is asked.

7 Generic modules are presented below, the differenciation is done with their size of managed data.

Mapping of modules		
Input data	Offset in the module	Length in bytes
Control word	0	2
Command	2	1
Read address	3	2
Read size	5	2
Write address	7	2
Write size	9	2
Timeout	11	2
Data to write	13	**
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1
Data read	3	**

Module ID	Module Name	** Length in bytes (size of “Data to write” and “Data read”)
0x0301	Generic 8 bytes CYC	8
0x0302	Generic 16 bytes CYC	16
0x0304	Generic 32 bytes CYC	32
0x0318	Generic 64 bytes CYC	64
0x0310	Generic 128 bytes CYC	128
0x0320	Generic 256 bytes CYC	256
0x0340	Generic 512 bytes CYC	512

5.4.5 ACYCLIC PARTIAL MODULE

Acyclic “partial” module could be used to realise many functions into a TAG on a channel. These functions are defined into a byte named **Command** that can has value and corresponding function defined in this table:

Command (the 3th byte into generic module)	
Value	**Description**
1	Read data
2	Write data
3	Write and read data
4	Fill data (with a byte value)
5	Get last UID

Write and read data command (0x3) is used to write data into a TAG and to read data from a TAG with the same request. Write request is realised first and the parameters are sent using **write address**, **size** and **data to write** elements into the module. After the write, the read request is done and parameters used are **read address** and **read size**. The result of the read command are placed into the **data read** element into the module.

Fill data command (0x4) is used to fill a TAG memory area with a specific pattern. This pattern is the first byte of the **Data to write** element in the module. The **address** and the **size** are the ones used for Write command.

Get last UID command (0x5) is used to retreive the last or current UID TAG as explained in the Read UID module (see chapter 5.4.1). The UID value is present into the first 8th bytes of the **Data read** element in the module.

All the paramters of the modules are:

- Command : byte command to set the request.
- Read address : address word where the read starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Read size : read size word is the asked read data length given in a granularity of byte.
- Write address : address word where the write starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Write Size : size word is the write data length given in a granularity of byte.
- Timeout : the wait time before terminating the attempt to execute the command and generating an error. Time interval is 10ms (1 = 10ms, 2 = 20ms …):
  - 0 value => the command is executing immediately
  - 0xFFFF => the wait time is infinite (command will be executed only if a TAG is been presented in front of the transceiver).

Control, status and request **parameters** are sent cyclically. **The data part** is sent **acyclically** using the Write/read record functions over the non real-time channel.

Data write record index 0x0200 to 0x023F

Data to write: the values of the data bytes to write into the memory TAG. Also used to transmit the fill pattern byte.
This record is accessed by page of 1024 bytes maximum length each. The total length of this record is 64 Kbytes (64 pages of 1 Kbytes).
The first data write page of 1 Kbytes is accessible using the record index 0x0200, the second page using the record 0x0201 and so on for the last page (64^{th}) using the record index 0x023F.

Data read record index 0x0100 to 0x013F

Data read: the result of the data read from the TAG memory. Also used to retreive Last UID TAG if Get last UID command is asked.
This record is accessed by page of 1024 bytes maximum length each. The total length of this record is 64 Kbytes (64 pages of 1 Kbytes).
The first data read page of 1 Kbytes is accessible using the record index 0x0100, the second page using the record 0x0101 and so on for the last page (64^{th}) using the record index 0x013F.

Partial module is presented below.

Mapping of modules		
Input data	Offset in the module	Length in bytes
Control word	0	2
Command	2	1
Read address	3	2
Read size	5	2
Write address	7	2
Write size	9	2
Timeout	11	2
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1
Acyclic records	Index	Length in bytes
Data write	0x0200 0x0201 ... 0x023F	1st K 2nd K ... 64th K
Data read	0x0100 0x0101 ... 0x013F	1st K 2nd K ... 64th K

5.4.6 ACYCLIC FULL MODULE

Acyclic “full” module could be used to realise many functions into a TAG on a channel. These functions are defined into a byte named **Command** that can has value and corresponding function defined in this table:

Command (the 3th byte into generic module)	
Value	**Description**
1	Read data
2	Write data
3	Write and read data
4	Fill data (with a byte value)
5	Get last UID

Write and read data command (0x3) is used to write data into a TAG and to read data from a TAG with the same request. Write request is realised first and the parameters are sent using **write address**, **size** and **data to write** elements into the module. After the write, the read request is done and parameters used are **read address** and **read size**. The result of the read command are placed into the **data read** element into the module.

Fill data command (0x4) is used to fill a TAG memory area with a specific pattern. This pattern is the first byte of the **Data to write** element in the module. The **address** and the **size** are the ones used for Write command.

Get last UID command (0x5) is used to retreive the last or current UID TAG as explained in the Read UID module (see chapter 5.4.1). The UID value is present into the first 8th bytes of the **Data read** element in the module.

Control and status are sent cyclically. Request **parameters and data part** are sent **acyclically** using the Write/read record functions over the non real-time channel.

Parameter record index 0x0010 – 0x001A

This record is 11 bytes length, it gives access to the paramters of the modules that are:

- Command : byte command to set the request.
- Read address : address word where the read starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Read size : read size word is the asked read data length given in a granularity of byte.
- Write address : address word where the write starts into the TAG memory. This address is given for a TAG memory mapping in byte.
- Write Size : size word is the write data length given in a granularity of byte.
- Timeout : the wait time before terminating the attempt to execute the command and generating an error. Time interval is 10ms (1 = 10ms, 2 = 20ms …):
  - 0 value => the command is executing immediately
  - 0xFFFF => the wait time is infinite (command will be executed only if a TAG is been presented in front of the transceiver).

Mapping of parameter record		
Parameter name	Offset in the record	Length in bytes
Command	0	1
Read address	1	2
Read size	3	2
Write address	5	2
Write size	7	2
Timeout	9	2

Data Write Record Index 0x0200 to 0x023F

Data to write: the values of the data bytes to write into the memory TAG. Also used to transmit the fill pattern byte.
This record is accessed by page of 1024 bytes maximum length each. The total length of this record is 64 Kbytes (64 pages of 1 Kbytes).
The first data write page of 1 Kbytes is accessible using the record index 0x0200, the second page using the record 0x0201 and so on for the last page (64th) using the record index 0x023F.

Data Read Record Index 0x0100 to 0x013F

Data read: the result of the data read from the TAG memory. Also used to retreive Last UID TAG if Get last UID command is asked.
This record is accessed by page of 1024 bytes maximum length each. The total length of this record is 64 Kbytes (64 pages of 1 Kbytes).
The first data read page of 1 Kbytes is accessible using the record index 0x0100, the second page using the record 0x0101 and so on for the last page (64th) using the record index 0x013F.

Full module is presented below.

Mapping of modules		
Input data	Offset in the module	Length in bytes
Control word	0	2
Output data	Offset in the module	Length in bytes
Status word	0	2
RF status byte	2	1
Acyclic records	Index	Length in bytes
Parameters	0x0010	11
Data write	0x0200 0x0201 **...** 0x023F	1st K 2nd K **...** 64th K
Data read	0x0100 0x0101 **...** 0x013F	1st K 2nd K **...** 64th K

5.4.7 CONTROL WORD

The Control word contains bits used to enable various features of the BPNF80 module. This word is located at byte 0 of the Input data for each module.

Bits 15-13	Bit12	Bit11	Bits 10-8	Bit 7	Bit 6	Bits 5-4	Bit 3	Bits 2-0
Reserved	CC1	CC0	Reserved	Soft reset	Repeat cmd	Reserved	Disable ER	Reserved

Control word	Bit 0	Reserved	Always 0
	Bit 1	Reserved	Always 0
	Bit 2	Reserved	Always 0
	Bit 3	Disable ER	Setting this bit True (1) will stop the automatic detection of TAG in front of the transceiver as long as this bit is set to 1.
	Bit 4	Reserved	Always 0
	Bit 5	Reserved	Always 0
	Bit 6	Repeat command	Setting this bit True (1) will force the channel to repeat the command currently executed as long as this bit is set to 1. In case the bit is reset during the execution of a command the current command will be completed.
	Bit 7	Soft Reset	Setting this bit True (1) will cancel any pending command at Channel of reset Error code in Balogh Status.
	Bit 8	Reserved	Always 0
	Bit 9	Reserved	Always 0
	Bit 10	Reserved	Always 0
	Bit 11	CC1	Command counter higher bit (CC1) and lower bit (CC0) to trig request => force to start the command execution.
	Bit 12	CC0	
	Bit 13	Reserved	Always 0
	Bit 14	Reserved	Always 0
	Bit 15	Reserved	Always 0

5.4.8 STATUS WORD

Word located at byte 0 of the Output data for each module, it provides feedback for events requested using the Control word:

Bit 15	Bit 14	Bit 13	Bit12	Bit11	Bits 10-9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bits 2-0
Res.	CD1	CD0	Ack. CC1	Ack. CC0	Res.	Target Present	Soft reset ACK	Repeat cmd active	Busy	Error	Disable ER active	Res.

Status word	Bit 0	Reserved	Always 0
	Bit 1	Reserved	Always 0
	Bit 2	Reserved	Always 0
	Bit 3	Disable ER active	Set to 1 to inform that automatic TAG detection is not active on the current channel.
	Bit 4	Error	Set to 1 to inform that the current command is in fault statement.
	Bit 5	Busy	Set to 1 to inform that a current command is always in execution.
	Bit 6	Repeat command active	Set to 1 to inform that the repeat function is active on the current command.
	Bit 7	Soft Reset active	Set to 1 to inform that the reset on the channel is ACK.
	Bit 8	Target Present	Set to 1 when a TAG is currently in front of the transceiver.
	Bit 9	Reserved	Always 0
	Bit 10	Reserved	Always 0
	Bit 11	Ack. CC1	Acknowledge command counter higher bit (Ack. CC1) and lower bit (Ack. CC0). Its inform the start execution of the current command when theirs values are the same as Control word bits CC1-CC0.
	Bit 12	Ack. CC0	
	Bit 13	CD1	Counter data higher bit (CD1) and lower bit (CD0) to inform that new data are available. When data are ready to be retreive at the end of command execution, this counter data is increased.
	Bit 14	CD0	
	Bit 15	Reserved	Always 0

5.4.9 RF STATUS BYTE

The byte number 2 of the Output data for each module provides the status of the current command that has been executed. This byte includes the Command Execution Status bit, which can be used for verifying the execution of a command.
This bit is initially high at power up and will transition low when a command has been accepted by the BPNF80. Upon completion of the command, it will return high. At that time, all other status bits will also be valid. The command status result is held until the execution of the next command or loss of power.

See annex 1 for details.

5.5 OPERATIONAL DESCRIPTION

5.5.1 CYCLIC MODULES PROCESS

Communicating with the BPNF80 is a simple process involving only a few steps. In order for the BPNF80 to execute a **Command** a **Contol Word** and its related **Command Parameters** must be transmitted to the BPNF80. The BPNF80 uses the **Output RTC frame** to accomplish this action.
The **Output RTC frame** is the cyclic data produces by the IO-Controller which is consumed by the IO-device. In the Modules defined before, it's the data field named "*Input data*" (from the IO-Device's point of view).

A **Command** for a module is comprised of multiple bytes and words of information. The first word of each module is the **Control Word** ,this word acts as a trigger to instruct the BPNF80 to evaluate the **Command Parameters** that will follow and determine if a valid **Command** request is present. The usage of the **Control Word** is key to the behavior of the BPNF80. Because this word acts as a trigger its default value is normally set to zero:

- when the value of CC1-CC0 bits does not change within the **Control Word** the BPNF80 will ignore that **Command Request Field**.
- when a valid instruction is placed within this word (using Control word bits CC1-CC0) the BPNF80 will validate the C**ommand parameters** and begin the execution of the command.

Hint:
To minimize the number of PLC operations the user can preload the **Command Parameters** of each required **Command Request Field** upon initialization of the PLC program. Then all that is required to execute a **Command** request is the writing of the **Control Word** when action is required.

Once a **Command** request is initiated the BPNF80 uses the **Input RTC frame** to convey the Execution Status of command in progress.
The **Input RTC frame** is the cyclic data consmes by the IO-Controller which is produced by the IO-device. In the Modules defined before, it's the data field named "Output *data*" (from the IO-Device's point of view).

For all module, the frist word of information is referred as the **Status Word** that is used to track the execution progress of each command.

The **Status Word** is associated with each **Control Word** in the module**.** This information is continuously communicated back to the IO-Controller. When a valid instruction is received the BPNF80 updates the **Status Word** associated with the **Control Word** at the start of the commands execution and will set the **Acknoledge Command Counter** bits (Ack.CC1-Ack.CC0).
Upon completion of the command, this word will be updated again with the **Counter data** bits (CD1-CD0) returned and any relevant fault information if generated will be updated. The IO-Controller will monitor this word to determine when a command has completed.

Using the same way, the **Rf status byte** presented in all module can be used to trig command execution. At the start of the commands execution, BPNF set the **Execution status** bit low (0). Upon completion of the command, this byte will be updated again with the **Execution status** bit returned high (1). General and specific fault bits are updated if an error occurs.

Important notice: the cyclic Input and Output RTC frame can not exceed 1440 bytes. This maximum length includes data modules bytes and Profinet protocol overhead bytes.

5.5.2 ACYCLIC MODULES PROCESS

Contrary to cyclic modules, acyclic ones use **acyclic read/write records** to send data and/or parameters.
The **Control** and **Status** mechanism stays cyclic using RTC frames as it is explained in the previous chapter.

The changes are for the parameters and data bytes exchanged.

For “**Partial**” acyclic module, request paramters stays into **Output RTC image** (named 'input data'). Only write and read data are sent using acyclic records (see memory mapping into the chapter named “Acyclic partial module”).

For “**Full**” acyclic module, request paramters, write and read data are sent using acyclic records (see memory mapping into the chapter named “Acyclic full module”).

5.6 CYCLIC READ REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller
Output RTC image : Load Command parameters into the Command request field in the module

Load parameters →

BPNF80
Command parameter fields : Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2 *

IO-Controller
Output RTC image : Send a command to the Control Word related the Command Counter bits requiring execution

Send command →

BPNF80
Control Word : Monitor Command Counter bits CC1-CC0

Step 3

IO-Controller
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low

Status
(running command) ←

BPNF80	
Status Word	
High byte	Low byte
Ack.CC1-Ack.CC0	/
RF Status byte	
Execution status bit low (0)	

Step 4

IO-Controller
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high. Retrieve read TAG data from the Data read bytes.

Status
(end of execution)
+
Read TAG data ←

BPNF80	
Status Word	
High byte	Low byte
CD1-CD0 incremented	/
RF Status byte	
Execution status bit high (1)	
Data read	
Read bytes into the TAG memory	

* **Important notice:** Step 1 and Step 2 can be done on the same step.

5.7 CYCLIC WRITE REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller
Output RTC image : Load Command parameters into the Command request field in the module

Load parameters →

BPNF80
Command parameter fields : Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2 *

IO-Controller
Output RTC image : Send data to write into the TAG memory using the Data to write bytes. Send a command to the Control Word related the Command Counter bits requiring execution.

Send command + Write TAG data →

BPNF80
Control Word
Monitor Command Counter bits CC1-CC0
Data to write
Retreive write data to send write command into the TAG

Step 3

IO-Controller
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low

← **Status (running command)**

BPNF80	
Status Word	
High byte	Low byte
Ack.CC1-Ack.CC0	/
RF Status byte	
Execution status bit low (0)	

Step 4

IO-Controller
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high.

← **Status (end of execution)**

BPNF80	
Status Word	
High byte	Low byte
CD1-CD0 incremented	/
RF Status byte	
Execution status bit high (1)	

* **Important notice:** Step 1 and Step 2 can be done on the same step.

5.8 ACYCLIC 'PARTIAL' MODULE READ REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller		BPNF80
Output RTC image : Load Command parameters into the Command request field in the module	**Load parameters** →	**Command parameter fields :** Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2 *

IO-Controller		BPNF80
Output RTC image : Send a command to the Control Word related the Command Counter bits requiring execution	**Send command** →	**Control Word :** Monitor Command Counter bits CC1-CC0

Step 3

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low	**Status (running command)** ←	**Status Word**	
		High byte	Low byte
		Ack.CC1-Ack.CC0	/
		RF Status byte	
		Execution status bit low (0)	

Step 4

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high.	**Status (end of execution)** ←	**Status Word**	
		High byte	Low byte
		CD1-CD0 incremented	/
		RF Status byte	
		Execution status bit high (1)	

Step 5

IO-Controller		BPNF80
Read record request Read TAG data from the Data read bytes.	→ **Read TAG data** ←	**Record : data read** Send TAG memory read bytes

* **Important notice:** Step 1 and Step 2 can be done on the same step.

5.9 ACYCLIC 'PARTIAL' MODULE WRITE REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller
Output RTC image : Load Command parameters into the Command request field in the module

Load parameters →

BPNF80
Command parameter fields : Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2

IO-Controller
Write record request Send TAG data to be written into the TAG memory.

→ **Write TAG data** ←

BPNF80
Record : data write
Retreive write data to send write command into the TAG

Step 3

IO-Controller
Output RTC image : Send a command to the Control Word related the Command Counter bits requiring execution.

Send command →

BPNF80
Control Word
Monitor Command Counter bits CC1-CC0

Step 4

IO-Controller
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low

Status
(running command) ←

BPNF80	
Status Word	
High byte	Low byte
Ack.CC1-Ack.CC0	/
RF Status byte	
Execution status bit low (0)	

Step 5

IO-Controller
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high.

Status
(end of execution) ←

BPNF80	
Status Word	
High byte	Low byte
CD1-CD0 incremented	/
RF Status byte	
Execution status bit high (1)	

5.10 ACYCLIC 'FULL' MODULE READ REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller		BPNF80
Write record request Send a write request to set the Command parameters into the Command record data in the module	**Load parameters**	**Record : parameters** Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2 *

IO-Controller		BPNF80
Output RTC image : Send a command to the Control Word related the Command Counter bits requiring execution	**Send command**	**Control Word :** Monitor Command Counter bits CC1-CC0

Step 3

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low	**Status** **(running command)**	**Status Word**	
		High byte	Low byte
		Ack.CC1-Ack.CC0	/
		RF Status byte	
		Execution status bit low (0)	

Step 4

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high.	**Status** **(end of execution)**	**Status Word**	
		High byte	Low byte
		CD1-CD0 incremented	/
		RF Status byte	
		Execution status bit high (1)	

Step 5

IO-Controller		BPNF80
Read record request Read TAG data from the Data read bytes.	**Read TAG data**	**Record : data read** Send TAG memory read bytes

See **annex 3** to have a synchronous operation description.

5.11 ACYCLIC 'FULL' MODULE WRITE REQUEST EXECUTION SEQUENCE

Step 1 *

IO-Controller		BPNF80
Write record request Send a write request to set the Command parameters into the Command record data in the module	→ **Load parameters** →	**Record : parameters** Command (in Generic module) Number Of Bytes Starting Address Time Out

Step 2

IO-Controller		BPNF80
Write record request Send TAG data to be written into the TAG memory.	→ **Write TAG data** →	**Record : data write** Retreive write data to send write command into the TAG

Step 3

IO-Controller		BPNF80
Output RTC image : Send a command to the Control Word related the Command Counter bits requiring execution.	→ **Send command** →	**Control Word** Monitor Command Counter bits CC1-CC0

Step 4

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Acknowledge Command Counter bits and/or RF status byte for the Execution status bit to transition Low	← **Status (running command)** ←	**Status Word**	
		High byte	Low byte
		Ack.CC1-Ack.CC0	/
		RF Status byte	
		Execution status bit low (0)	

Step 5

IO-Controller		BPNF80	
Input RTC image : Monitor related Status Word testing for the Counter Data bits and/or RF status byte for the Execution status bit to transition high.	← **Status (end of execution)** ←	**Status Word**	
		High byte	Low byte
		CD1-CD0 incremented	/
		RF Status byte	
		Execution status bit high (1)	

See **annex 4** to have a synchronous operation description.

6 DIAGNOSTICS AND ALARMS

BPNF80 uses the Alarm real time communication channel to send or receive diagnostic data.

Diagnostics signaling by the BPFN80 can be **general faults** (slot error, initialisation error …) or **process faults** (RFID contract error, transceiver connection failure ...).

Some of these Device faults need a physical maintenance to correct the problem, in this case the “severity” level is “maintenance required”. For the others faults, the “severity” level can be “maintenance demanded” or “normal”.

All diagnostics (identification number is named 'Error type') are details in the tables below.

General faults			
Error type	Diagnostic	Severity	Description
16	Slot out of order	Maintenance Demanded	Slot not available. Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.
17	Internal error 1	Maintenance Demanded	Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.
18	Internal error 2	Maintenance Demanded	Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.
19	Internal error 3	Maintenance Demanded	Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.
20	Internal error 4	Maintenance Demanded	Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.
21	Internal error 5	Maintenance Demanded	Please restart the equipment. If the problem persists, it may be necessary to replace the equipment.

Process faults			
Error type	Diagnostic	Severity	Description
100	The RFID contract failed	Normal	Bad parameter received by the device into the command sent by the IO-Controller.
101	The RFID contract failed	Normal	Communication problem with the internal RF transceiver.
102	The RFID contract failed	Normal	Incorrect address received by the device into the command sent by the IO-Controller.
103	The RFID contract failed	Normal	Timeout occurs when trying to execut the command sent by the IO-Controller.
104	Transceiver failure	Maintenance Demanded	Transceiver disconnected. Please check the cable.
105	The RFID contract failed	Normal	The command has begun executing but has been interrupted.

The process faults are also provided by the BPNF80 into the RF Status byte of the cyclic output data (detailed in annex 1).

The correspondence between Error type and LSB of RF Status byte (fault code bits) is:

Error type	RF Status LSB
100	1
101	5
102	E
103	F
104	C
105	A

7 CONFIGURATION EXAMPLE

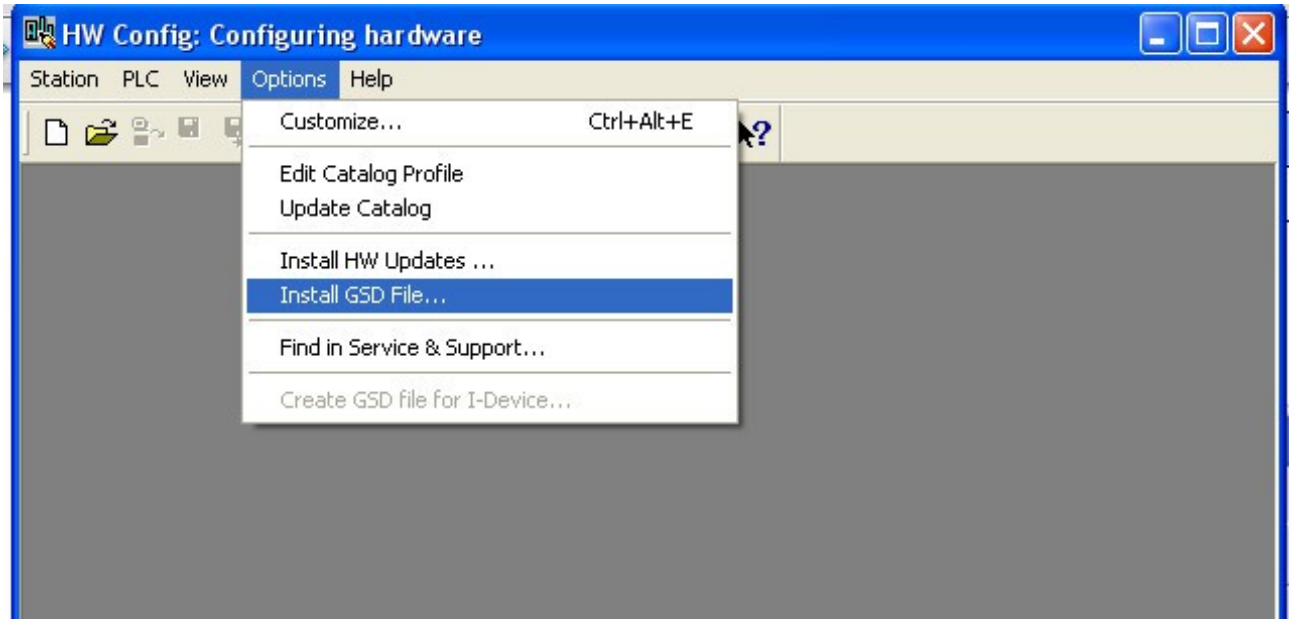
This chapter will illustrate how to setup and configure a PROFINET encoder for working in RT Class 1 mode with SIMATIC MANAGER. In the following examples Siemens STEP 7 V5.4 +SP5 PLC and CPU 315F-2PN/DP is used. Please refer to the manufacturer if other configuration tools are being used.

7.1 DEVICE DESCRIPTION FILE INSTALLATION (GSDML)

In order to start using an absolute encoder with PROFINET interface, a device description file needs to be downloaded and imported to the configuration software. The device description file is called a “Generic Station Description Markup Language” file and contains the necessary implementation parameters needed for a PROFINET IO device. The GSDML file can be downloaded from www.balogh-rfid.com

GSDML file: GSDML-V2.31-Balogh-RFID-xxxxxx.xml

Installation of GSDML-files in SIMATIC MANAGER:



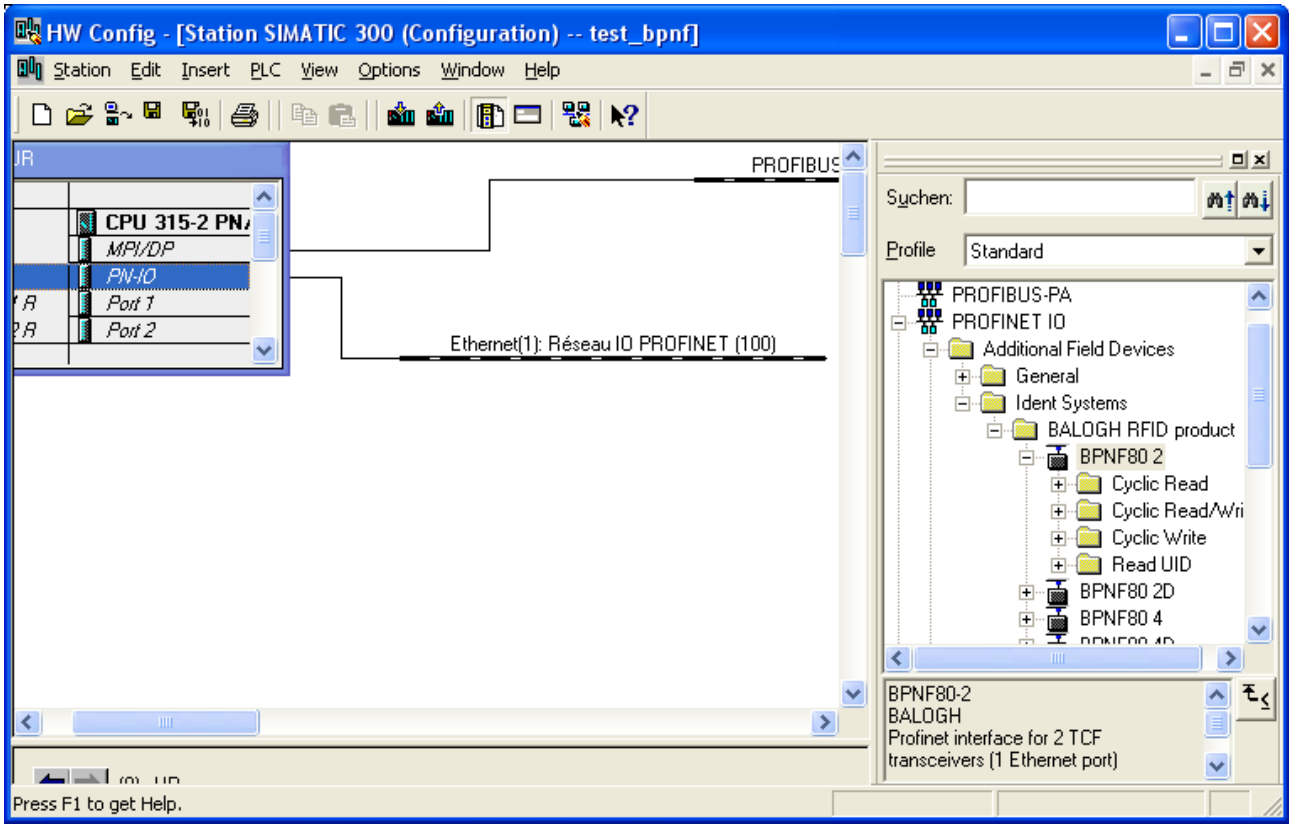
1) Select Options -> Install GSD File and click the “Browse” button to navigate to the location of the GSD file. If a bitmap picture representing the encoder is requested, make sure that the bitmap file is located in the same folder as the GSDML file. A bitmap file is included in the zip-file downloadable from www.balogh-rfid.com.
2) Select the GSD file and click the “Install” button to start installing the selected GSD file.

7.2 SETTING THE PRODUCT CONFIGURATION

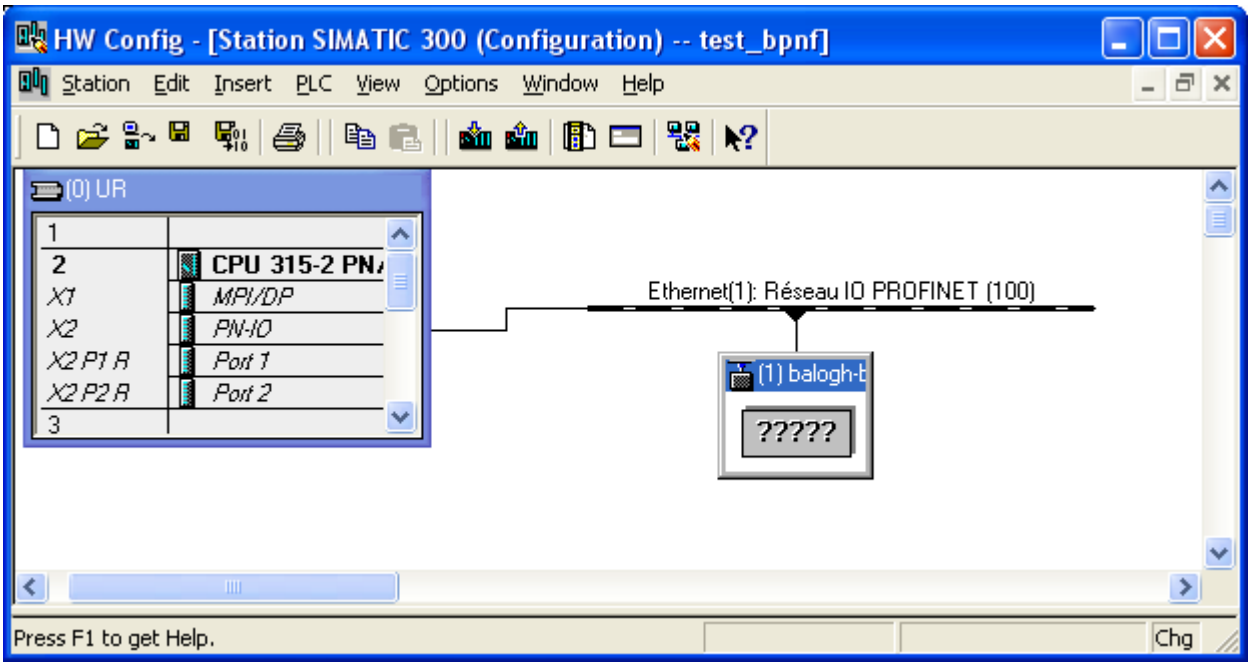
When the GSD file has been installed the product can be found in the SIMATIC MANAGER-> HW Config under

PROFINET IO->Additional Field Devices->Ident systems->BALOGH RFID product

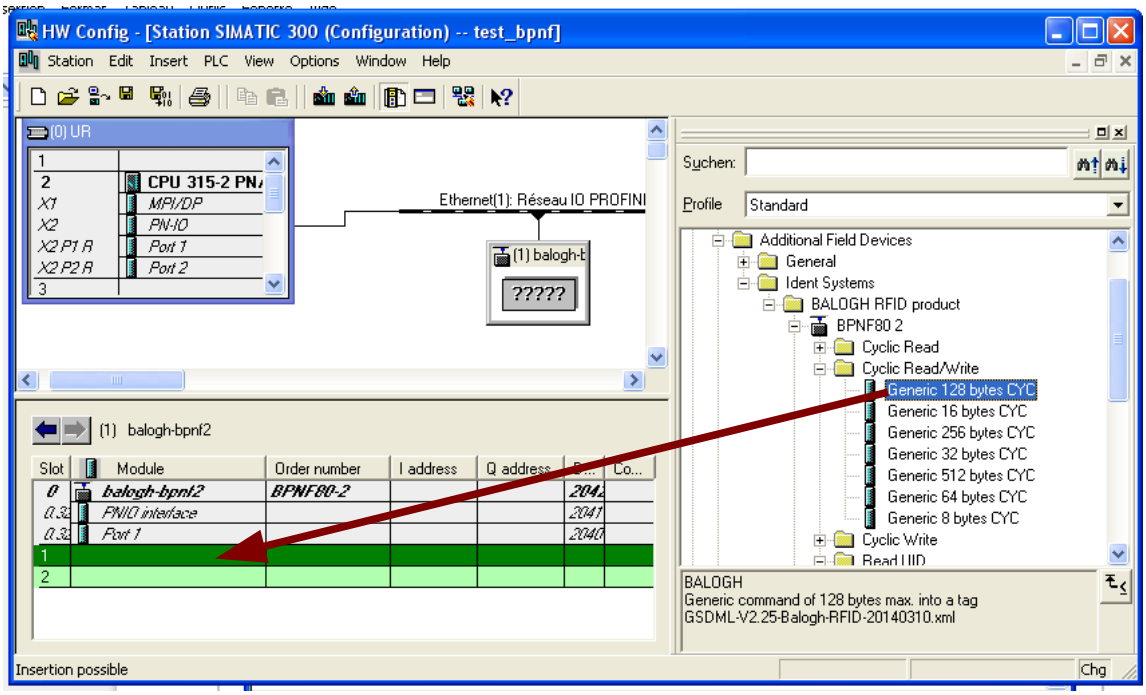
Select either BPNF80 2. Drag and drop the encoder onto the PROFINET IO system as shown in the picture below.



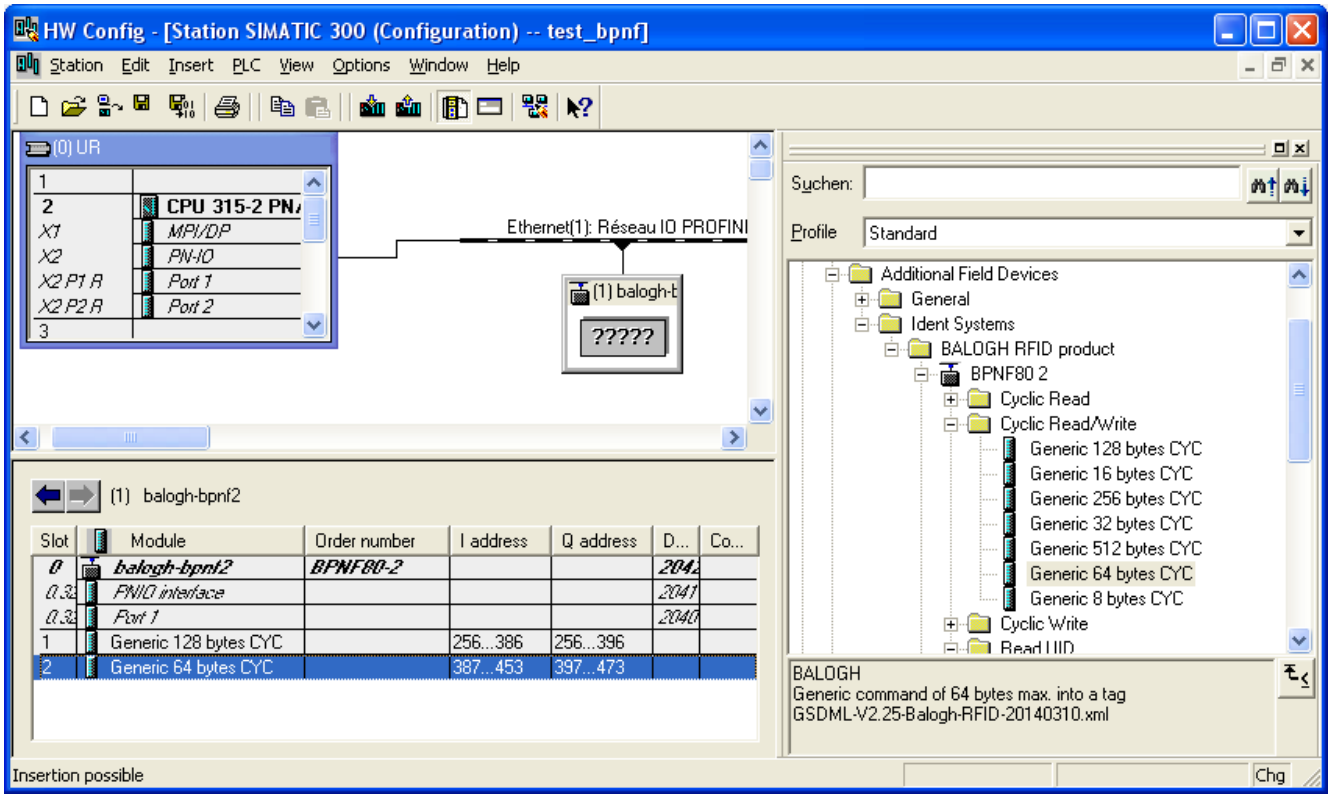
When correctly done, a BPNF will appear on the PROFINET IO system as shown in the picture below.



The next step will be to choose the module type and data length for each channel on slot 1 and slot 2, This is done by choosing different modules:

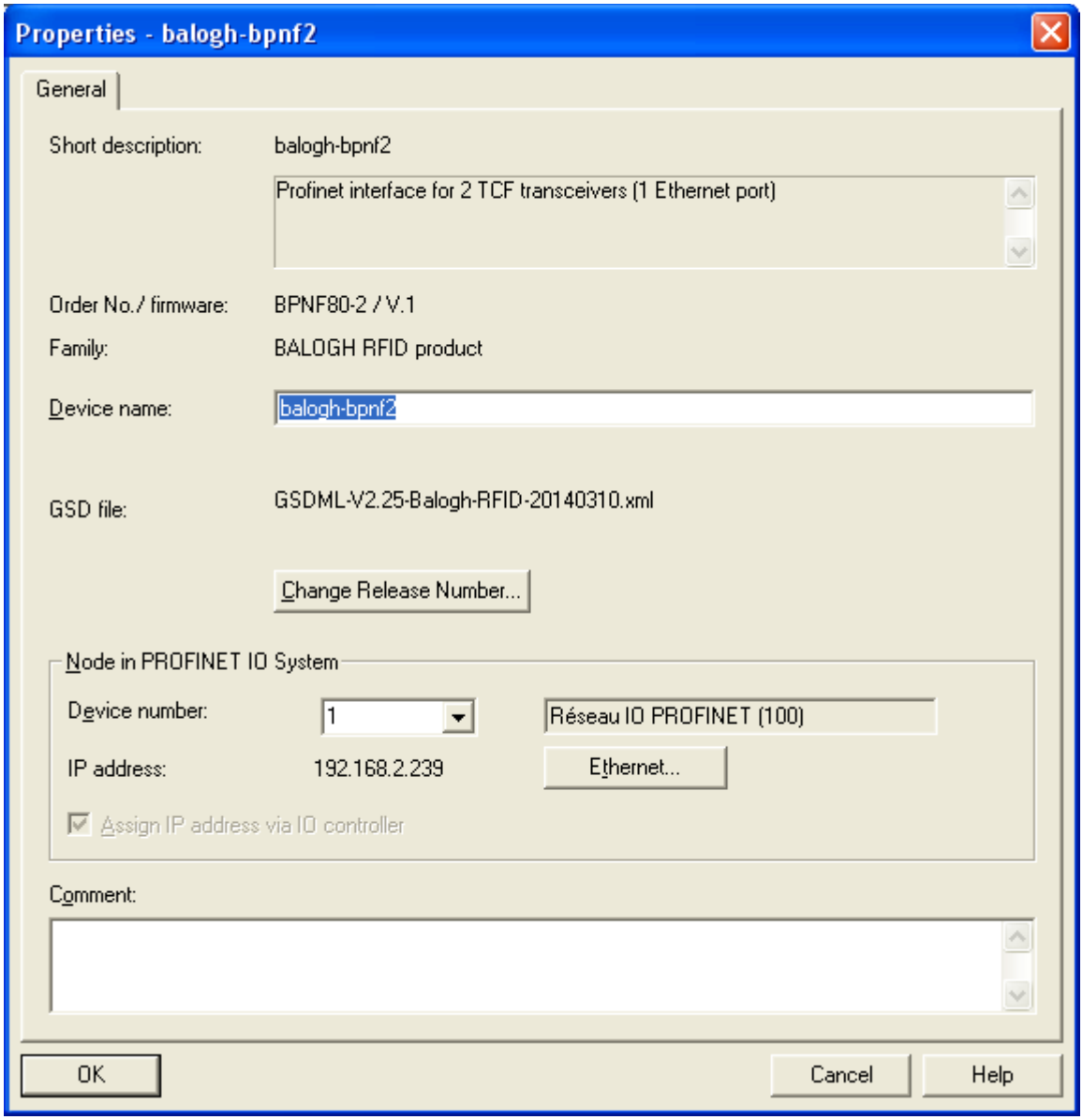


The chosen module will appear on slot 1 and slot 2.



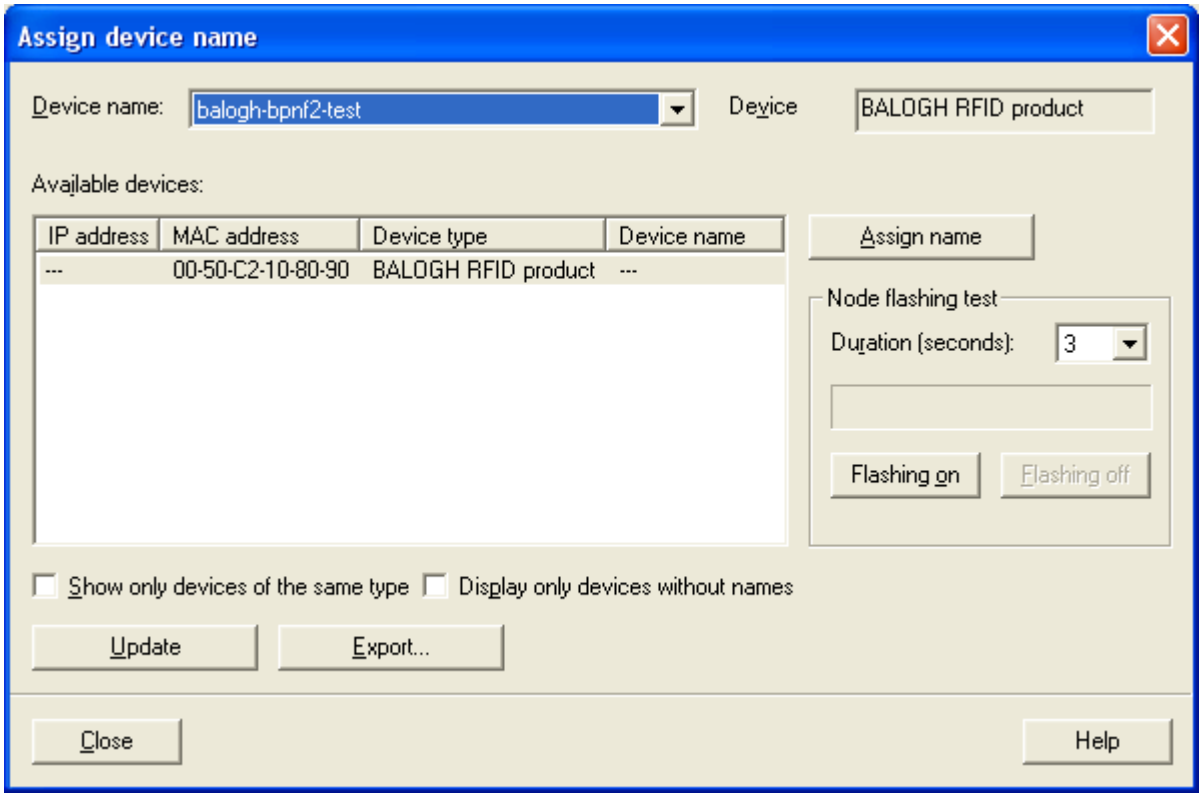
7.3 SET ENCODER DEVICE NAME

In PROFINET network all IO devices needs to have a unique device name. Balogh's PROFINET products are delivered without any device name preset from the factory. To set the product device name, double click on the encoder icon to open the Properties window.



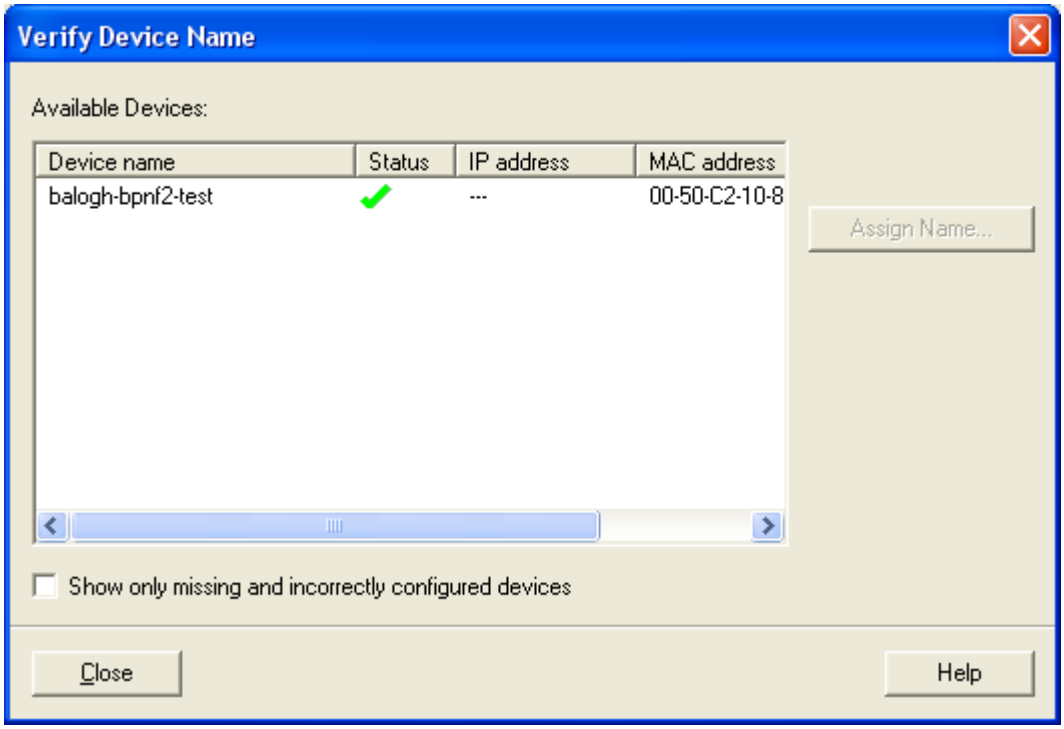
In the Properties dialog window, enter an appropriate device name in the “Device name” field.

Then select PLC-> Ethernet->Assign Device Name to open the “Assign device name window”.



After changing device name, it is recommended to verify the performed changes.
This is done by opening the “Verify Device Name” window found under PLC->Ethernet->Verify Device Name.

In the ”Verify Device Name” dialog window, verify that the “Device name” has changed and the status is OK as shown in the picture below.

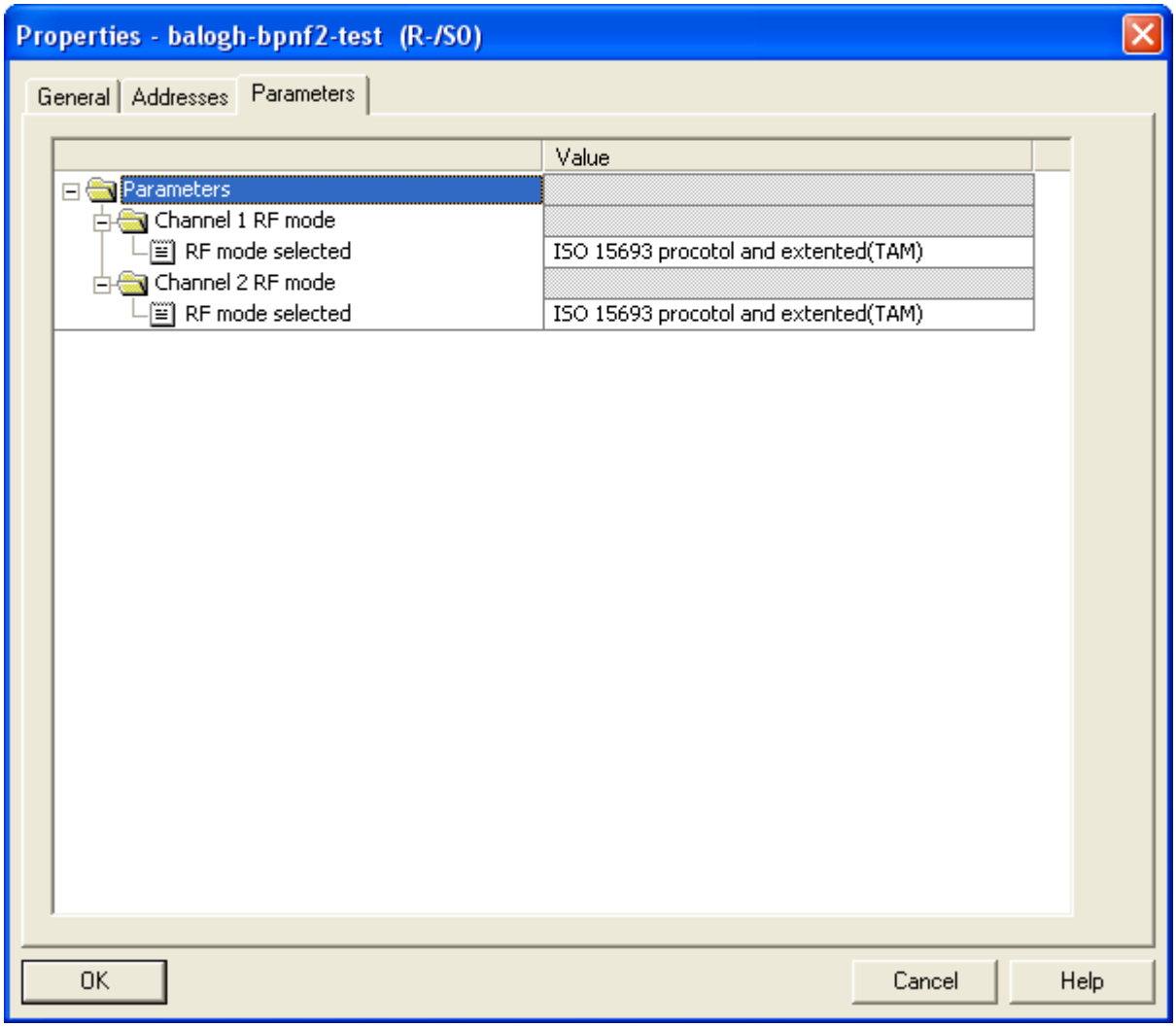


7.4 SETTING RF PARAMETERS

This chapter describes how to change the user parameters in the encoder.

To set the RF parameters double click on the BPNF80-2 Slot:

Select the parameters tab



Change the “RF mode selected” for each channel

8 MAINTENANCE

Using the same way that configuration, it is possible to have access to maintenance with the Web server.

To connect to BPNF80 web server, enter the IP address of the product in the address bar.

If the product is protected by a user account, please give Account name and password (by default it is 'root' and 'balogh').

8.1 FAULT INFORMATION ACCESS

Open the html page 'Troubleshooting' using the Web server menu. This page displays dynamic tables with counters (since the product has started):

- Ethernet exchanges information => tab **Network stats**
- Number of active connexions by used protocol => tab **Used protocol**
- Channel status, operations and results => tab **RFID operations**
- The last radiofrequency 50 operations (by channel) that terminated in error with execution dating (since the product has started) => tab **Last 50 RF errors**
- user can do an actions to blink LEDs => tab **Actions**

To find specific faults that could have occurred during radiofrequency exchanges, the table **RFID operations** gives :

- number of detected TAG
- number of realised operation and details between the success ones and fault ones
- number of error detected (global and by error type)
- the hexa code of the last error (the status LSB gives the error maening) and his execution dating
- the hexa code of the live status and a information of command execution

RFID operations

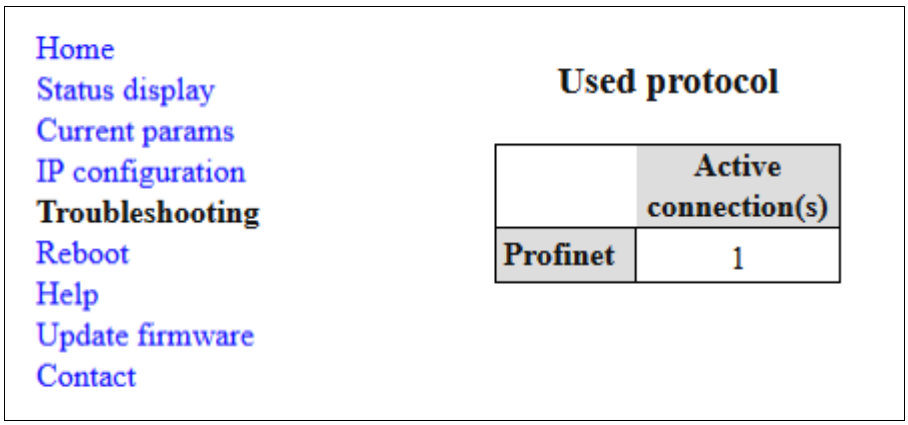
	Channel 1	Channel 2
Tag counter	2	1
Operation counter	0	0
Operation OK	0	0
Operation Error	0	0
Error counter	0	0
Tag dialog error	0	0
Transceiver error	0	0
Other error	0	0
Last Error	00	00
Last Error uptime		
Status	80	A0
Command in progres	--	--

To have the meaning of the Status and so to know in detail the error meaning of the status LSB bits, please see annex 1.

8.2 PROFINET ACTIVE CONNECTION

It is possible to know if a Profinet connection is active.
For this, open the html page 'Troubleshooting' (see chapter 4 to establish a connection with the Web server).

Update the html page using the keyboard F5 button.



8.3 REBOOT SERVICE

At any moment it is possible to reboot the BPNF80 using the Web server.
For this, open the html page 'Reboot' and click on the button Reboot .

If the BPNF80 restarts, the message '**Rebooting...**' is displayed in the Web server page.

8.4 FIRMWARE UPDATE

To update the BPNF80 firmware, choose 'Update firmware' menu in the Web server. If the product is protected by a user account, please give Account name and password (by default it is 'root' and 'balogh').
Using the button Parcourir... select the file named 'image.bin' corresponding to the new firmware.

After that click on the button Upload to send the new firmware into the BPNF80. The message 'Upload in progress. Please wait...' tells that the upload is in progress.

Once the update is done the message below is displayed on the top of the Web server page:

Image file uploaded successfully. You must reboot for changes to take effect.

Automatically the BPNF80 restarts on the new firmware.

9 ANNEXES

9.1 ANNEX 1 : BALOGH STATUS BYTE

Status byte gives service information with the next bits:

	Bit number	Description
MSB	7	Execution bit : 1 if no command is in execution 0 when the command is in execution
	6	Not used
	5	TAG presence => 1 if a TAG is present in front of transceiver.
	4	Fault bit => 1 if error (fault describs with bits 0 to 3).
LSB	0 to 3	Fault code (enable if **bit 4** = 1) : see next table

Status byte is reliable if only **bit 7 is equal to 1** (finished operation) :

B7	B6	B5	B4	B3 B0
Execution		TAG presence	Fault bit	Fault code
0				
1			0	
			1	Fault quartet

example : A0h means that the request has been executed and the TAG is present.

LSB :

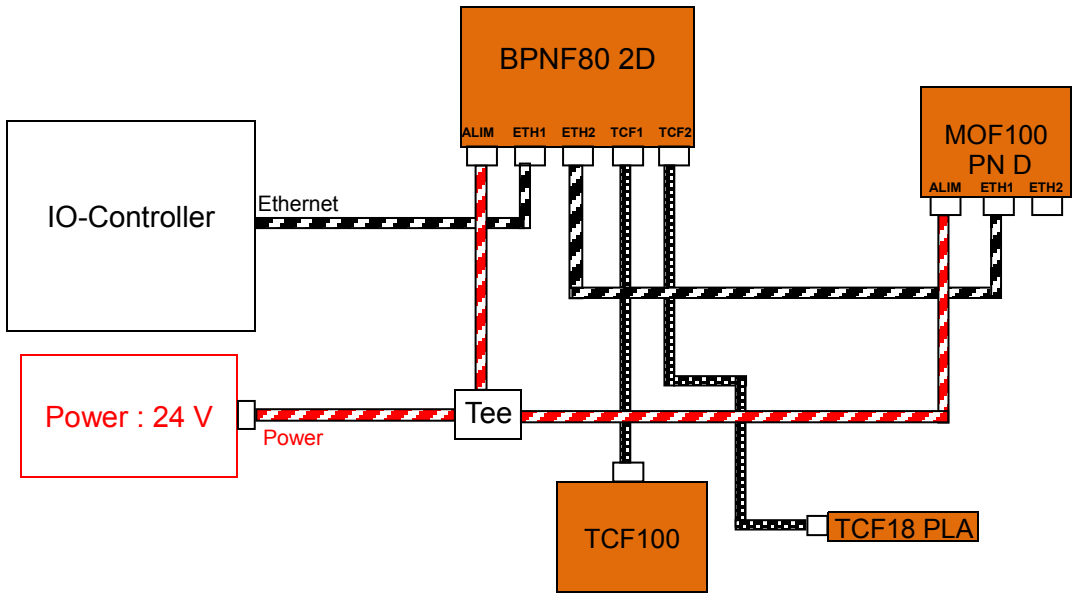
hexa	**3**	**2**	**1**	**0**	**<--- bit n° meaning**
1	0	0	0	1	Invalid parameter in the request
5	0	1	0	1	Internal channel communication fault
A	1	0	1	0	Unable to complete the TAG dialog
C	1	1	0	0	Transceiver or transceiver connection failure
E	1	1	1	0	Tag adressing error
F	1	1	1	1	TAG dialog fault (ex : time-out expired)

9.2 ANNEX 2 : CURRENT CONSUMPTION CALCULATION

Example: network composed of a BPNF80 2D (with 2 TCF) and a MOF100 PN D

Architecture is: a BPNF80 2D connected with a TCF100 and a TCF18 PLA. On this BPNF80 2D a MOF100 PN D is linked to the network. The IO-Controller uses Profinet protocol to managed the equipments.

This diagram presents the assembly:



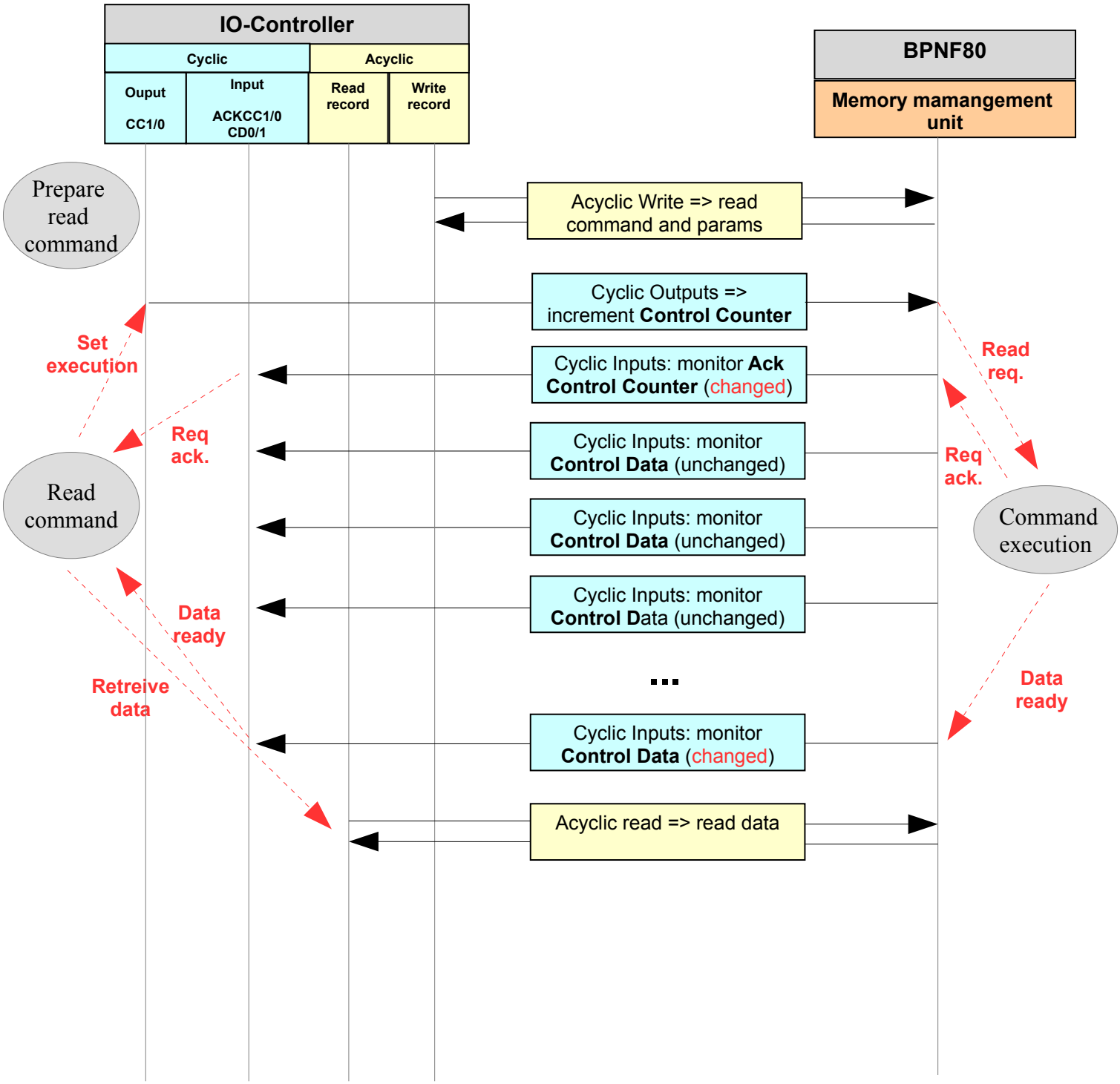
Current consumption balance must be done for this architecture so as to determine the maximum current consumption on the 24V Power supply.
In this case BPNF80 2D and MOF100-PN D are connected on the same 24V power supply using a tee.
On the BPNF80 are connected a TCF100 and a TCF18 PLA and theirs maximum current consumptions are respectively 90mA and 70mA.

For a DC 24 V power supply the calcul is:

	Max current cons. *in mA*
BPNF80 2D	150
TCF100	90
TCF18 PLA	70
MOF100 PN D	120
Total	**430**

That is to say 430 mA of maximum current consumed on the 24V.

9.3 ANNEX 3 : SYNCHRONOUS OPERATION FOR ACYCLIC 'FULL' MODULE READ REQUEST



9.4 ANNEX 4 : SYNCHRONOUS OPERATION FOR ACYCLIC 'FULL' MODULE WRITE REQUEST